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"Man invents—there lies his strength."—DE LA MARTINE.

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LIST OF NEW PATENTS GRANTED FOR ENGLAND, SCOTLAND, AND IRELAND.

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LIST OF IRISH PATENTS, FROM JULY 12, 1843, TO APRIL 17, 1844.

John Hutcheson, flax grower, and James Edgan, carpenter, both of Killycavin, near Markethill, Armagh, for machinery which may be worked by water, steam, or any other propelling power, for breaking and scraping flax, on a system entirely new, without danger to human life, whereby the flax is greatly improved and cleansed in a very superior manner, and the value of it much enchanced. Sealed, August 10, 1843.

Christopher Nickels, of York-road, Lambeth, Surrey, gentleman, for improvements in the manufacture of plaited fabrics. August 12, 1843.

Charles Payne, of South Lambeth, Surrey, Chemist, for improvements in preserving vegetable matters when metallic and earthy solutions are employed. August 12, 1843.

Sir John Scott Lillie, of Chelsea, Middlesex, Knight, for certain improvements in roads. August 17, 1843.

Thomas Cardwell, of Bombay, in the East Indies, merchant, for improvements in the construction of presses for compressing cotton and other articles. August 17, 1843.

Edmund Morewood, of Thornbridge, Derby, merchant, and George Rogers, of Chelsea, Middlesex, gentleman, for improved processes for coating metals. August 25, 1843.

Thomas Clarendon, of 101, Great Brunswick-street, Dublin, for an improved method of shoeing horses. Communication.) September 4, 1843.

Martyn John Roberts, of Bryn y Caeran, Carmarthen, gentleman, for certain improvements in machinery for preparing, spinning, and winding wool, cotton, flax, silk, or any other fibrous bodies. September 4, 1843.

Joseph Daniel Davidge, of Greville-street, Hatton-garden, St. Andrew, Holborn, Middlesex, machinist, for improvements in manufacturing certain materials as substitutes for whalebone, applicable to various useful purposes, and in the machinery for effecting the same. September 14, 1843.

Fennell Allman, of 9, Salisbury-street, Middlesex, Surveyor, for certain improvements in apparatus for the production and diffusion of light. September 28, 1843.

John Ainslie, of Redheugh, near Dalkeith, in North Britain, farmer, for certain improvements in the manufacture of tiles, bricks, retorts, and articles made from clay, and other plastic substances, and in the apparatus and arrangements for such manufacture. October 3, 1843.

Charles Maurice Elizée Sautter, of Austin-friars, London, gentleman, for improvements in the manufacture of borax. (Communication.) October 4, 1843.

Richard Laming, of Radley's Hotel, New Bridge-street, Blackfriars, London, gentleman, for improvements in the purification and application of ammonia to obtain certain chemical products. October 6, 1843.

James Overend, of Liverpool, Lancaster, gentleman, for improvements in printing fabrics with metallic matters, and in finishing silks and other fabrics. October 25, 1843.

John Wood, of Parkfield, Birkenhead, Chester, merchant, for certain improvements in machinery

or apparatus for affording additional or artificial buoyancy to sea-going or other vessels, or for lessening their draught of water, and which said improvements are also applicable to raising vessels, or other heavy bodies, and for securing and supporting the same. October 25, 1843.

Ernst Lentz, of Eastcheap, London, gentleman, for improvements in machinery for raising and forcing water and other fluids, which machinery, when worked by steam or water, may be employed for driving machinery. October 25, 1843.

Stephen Bencraft, of Barnstaple, Esq., for improvements in the construction of saddle-trees. October 31, 1843.

William Needham, of Birmingham, Warwick, gentleman, for improvements in firearms. October 31, 1843.

Alfred Jeffery, of Lloyd-street, Pentonville, Middlesex, gentleman, for a new method of preparing masts, spars, and other wood, for ship building and other purposes, and also a new method of defending the sheathing of ships, and protecting the sides and bottoms. November 7, 1843.

Charlton James Wollaston, of Welling, Kent, gentleman, for improvements in machinery for cutting marble and stone. November 7, 1843.

Frederick Steiner, of Hyndburn Cottage, near Accrington, Lancaster, Turkey-red dyer, for a new manufacture of a certain colouring matter, commonly called "garancine." November 7, 1843.

Lemuel Wellman Wright, of Wrexham, Denbigh, North Wales, engineer, for certain improvements in machinery or apparatus for bleaching various fibrous substances, and improvements in machinery or apparatus for converting or manufacturing the same into paper. November 27, 1843.

James Combe, of Leeds, York, engineer, for improvements in hackling, cleaning, preparing, and carding flax and other fibrous substances. November 28, 1843.

Nicholas Troughton, of Swansea, Glamorgan, South Wales, gentleman, for improvements in dressing ores requiring washing. November 29, 1843.

Arthur Dunn, of Rotherhithe, Surrey, soap boiler, for improvements in treating, purifying, and bleaching oils and fatty matters, and in making soap. December 6, 1843.

George Edmund Donisthorpe, of Bradford, York, top manufacturer, for improvements in combing and drawing wool and certain descriptions of hair. December 13, 1843.

William Wylam, of the borough and county of Newcastle-upon-Tyne, for an artificial composition, which, if variously modified, may be applied in preparing fuel from coal and other substances, or as a cement, or as a substitute for stone, or as a coating for metals and other substances. December 27, 1843.

Francis L'Estrange, of Dawson street, Dublin, Master of Arts, Fellow of the Royal College of Surgeons of Ireland, for improvements in hernial trusses to prevent the descent of hernia through the internal as well as the external ring. February 6, 1844.

Thomas Drayton, of Brighton, Sussex, gentleman, for improvements in coating glass with silver for looking-glasses and other uses. February 12, 1844.

William Prosser, jun., of Shaftesbury-terrace, Pimlico, gentleman, for improvements in the construction of roads, and carriages to run thereon. February 15, 1844.

George Gwynne, of Regent-street, Middlesex, gentleman, and George Fergusson Wilson, of Belmont, Vauxhall, Surrey, gentleman, for improvements in the manufacture of candles, and in apparatus for, and processes of, treating fatty and oily matters to obtain products for the manufacture of candles and other uses. February 15, 1844.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draftsman, for improvements in the manufacture of cyanogen and its compound, particularly the prussiates of potash and soda. (Communication.) February 27, 1844.

Margaret Henrietta Marshall, of Manchester, Lancaster, for a certain improved plastic composition, applicable to the fine arts, and to useful and ornamental purposes. March 8, 1844.

Hamilton Wood, of No. 5, Henrietta-street, Covent Garden, Middlesex, gentleman, for an improvement in producing uneven surfaces in wood. March 8, 1844.

William Wilson, John Studholme Brownrigg, John Cockerell, and Sir George Gerard De Hochepied Larpent, Bart, all of Belmont, Lambeth, Surrey, patent cocoa-nut candle and oil manufacturers, and cocoa nut oil merchants, for an extension of an invention for three years, from September 9, 1844, of a new preparation or manufacture of a certain material produced from a vegetable substance and the application thereof to the purposes of affording light, and other uses. March 14, 1844.

John Kibble, of Glasgow, gentleman, for improvements in apparatus for propelling vessels, and in transmitting power in working machinery where endless belts, chains, or straps, are or may be used. March 14, 1844.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for a new improved system of machinery, or apparatus, for obtaining and applying motive power for propelling on railways or water, and for raising heavy bodies; applicable also to various other purposes where power is required. (Communication.) March 27, 1844.

Edward Eyre, of Thavies-inn, Holborn, London, gentleman, for improvements in railways, and in the machinery or apparatus employed thereon. (Communication.) March 27, 1844.

Pierre Pelletan, of Fitzroy-square, Middlesex, Esq., for improvements in the production of light. April 17, 1844.

Thomas Aspinwall, of Bishopsgate Church-yard, London, Esq., for improved cannon, formed either of wrought-iron or steel, or wrought-iron and steel combined, and also instruments and machinery used in making, and a method of making the said cannon. (Communication.) April 17, 1844.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1065.] SATURDAY, JANUARY 6, 1844. [Price 3*d*.

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DR. PAYERNE'S DIVING-BELL.

Fig. 1.

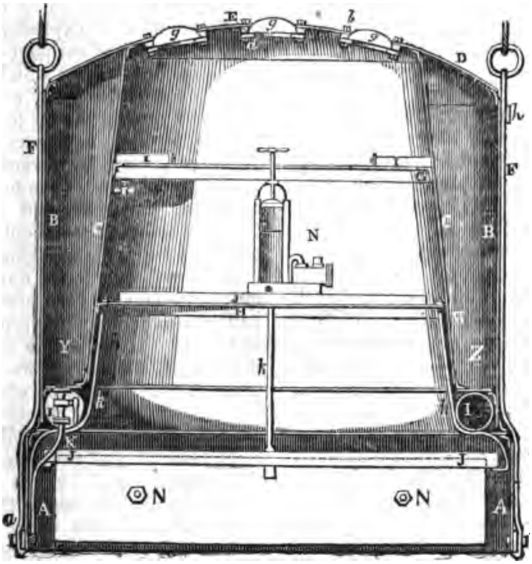
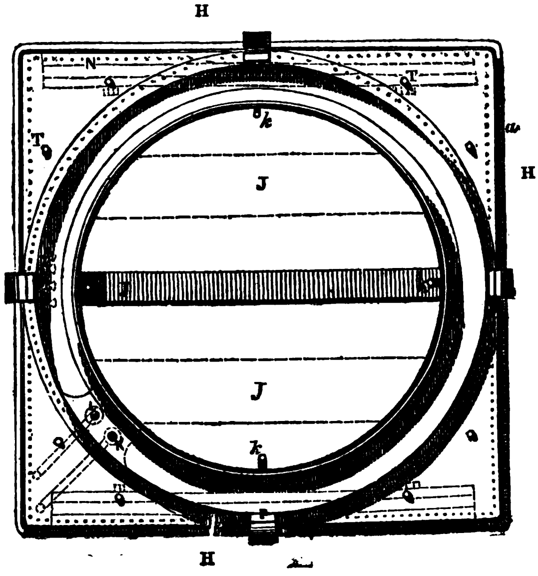


Fig. 2.



DR. PAYERNE'S IMPROVED METHODS OF SUPPORTING RESPIRATION IN CONFINED PLACES, AND OF PURIFYING MINES, FACTORIES, HOSPITALS, ETC.

[Patent dated, June 15, 1843; Specification enrolled, December 15, 1843.]

When about eighteen months ago Dr. Payerne made his well-remembered exhibitions at the Polytechnic Institution, West India Docks, &c., (see *Mech. Mag.*, vol. xxxvii., pp. 185 and 260,) a patent for England was at the same time taken out (July 7, 1842) on his behalf by Mr. William Revell Vigers, for a "mode of keeping the air in confined places in a pure or respirable state to enable persons to remain at work under water, and in other places, without a constant supply of atmospheric air;" which patent was duly specified January 7, 1843. Since then Dr. Payerne has made several valuable improvements in his invention, which form the subject of a patent taken out in his own name 15th June last, and specified on the 15th of last month. All the notices which we have previously given of Dr. Payerne's labours having been of a very general and cursory character, and having now before us the specifications of both patents, we propose, with the aid of these documents, to trace the Doctor step by step through his course of discovery and improvements to the point of superior practical efficiency at which he appears to have now arrived.

The Specification of the first patent (that in Mr. Vigers's name) gives the following statement of the means which Dr. Payerne *then* considered to be the best for accomplishing the objects he had in view:—

"The said mode of keeping the air in confined places in a pure or respirable state to enable persons to remain, or work under water and in other places without a constant supply of fresh atmospheric air, is performed by absorbing from the air, in confined places, the carbonic-acid gas, wherewith such air will always become more or less contaminated in consequence of the breathing of men and animals, or burning of candles, lamps, or gas-lights, or burning of fires of wood, charcoal, coals, turf, or other fuel, or in consequence of any evolution of carbonic-acid gas, or any explosion of gunpowder, which may take place in the said air in confined places. And further, in case such air is to be kept in a pure state by supplying the said air from which the carbonic-acid gas has been absorbed, as aforesaid, as much oxygen gas as may be requisite for replacing the oxygen which may have been abstracted from the said air during such breathing or burning, or such evolution or explosion as aforesaid. The absorption of carbonic-acid gas from air in confined places which has become contaminated with such acid gas, is effected by forcing the air to pass in a current or currents in contact with an alkali rendered caustic by means of recently-burned quick lime, so as to be capable of absorbing carbonic acid from the air which is so brought in contact with such caustic alkali and quicklime, which are to be mixed together in water. Or such quicklime may be used alone without alkali, and either in a pulverulent state and slaked, or the quicklime may be mixed with water, and the restoration of oxygen to air in confined places, which is become deficient thereof, is effected by allowing oxygen gas to escape gradually into such air from some kind of close vessel into which a large quantity of oxygen gas has been previously compressed with great force and retained therein under strong compression, or otherwise, by means of potash previously prepared in the state of peroxyde of potassium, that is, potassium charged with an additional portion of oxygen beyond what is contained in caustic potash, fragments of such peroxyde being put into water will emit, or give out the said additional portion of oxygen in the state of gas. Or otherwise, by means of chlorate of potash, or of peroxyde of manganese, or of both those substances, which, being submitted to heat in a suitable apparatus, will (as is well known) emit, or give out a portion of oxygen in the state of gas. And the oxygen gas, whether proceeding directly from such substances, or from compression in close vessels as aforesaid, by mixing with the air in confined places which has become deficient in oxygen (but which is already freed from carbonic-acid gas) will restore the said air to a pure or respirable state. The removal of carbonic-acid gas from the air in confined places is the most important part of the invention, and that alone will be sufficient for keeping the air in a respirable

state, in places which, although they may be confined places, nevertheless, contain a large quantity of confined air in proportion to the number of persons, or animals breathing, and of lights or fires burning in such confined air, such, for instance, as crowded theatres, courts of justice, and other public places, also the lower parts of the interior of large ships, the cells of prisons, wards of hospitals, and apartments of sick persons, also in extensive excavations of mines, in all which cases the ordinary means of ventilation can be practised with some effect. In still more confined places, and where such ventilation is difficult and inefficient, the restoration of oxygen will be important, as well as the removal of carbonic-acid, such for instance, as long and small galleries of deep mines, and in diving apparatus, or submarine boats or vessels, wherein persons are to remain and work under water; also in crowded transport ships, and hospital ships, where the quantity of confined air is small in proportion to the persons, animals, lights, or fires breathing or burning in such confined air. Respecting the absorption of carbonic-acid gas from the air in confined places, the said air is to be put in motion by some means which will produce a current thereof, and such current is to be passed in contact with the caustic alkali and quicklime, or with the quicklime."

A great many contrivances for giving motion to the vitiated air, and bringing it into contact with the absorbent and purifying mixtures, are then described; but we select the description given of what is truly termed "the simplest" of all, as illustrating better than any of the others the principles of this part of Dr. Payerne's system:—

"The invention may be practised in the simplest manner, with very ordinary apparatus; for instance, a common pair of leathern bellows for domestic use in kitchens, but strongly made, and in good condition, so as to blow forcibly, will serve for producing the required motion and current of the air in a confined place; and an ordinary wooden pail, or bucket, or earthen pan, or other like vessel, will serve to contain the caustic alkali and lime, and the water wherewith the same is to be mixed, or the quicklime and water, and by means of which water the ingredients are to be reduced to a liquid state. The quantities of those ingredients may in general be reckoned at the following rate for each person who is to breathe the air of the confined place in question, viz., four ounces of the potash of commerce of the best quality, and twenty ounces of newly burned quicklime, and about twelve pounds of fresh water. Or otherwise—two pounds of newly burned quicklime, and about sixteen pounds of fresh water, without alkali. The said ingredients or ingredient being mixed up in the water in the bucket, or other vessel, and the nozzle of the bellows being prolonged by an iron pipe, bended downwards, the end of that pipe is to be immersed in the liquid, so as to descend nearly to the bottom of the vessel, and then by blowing strongly with the bellows, the air of the place wherein the bellows are situated will, by action thereof, be blown downward some depth into the liquid, nearly to the bottom of the vessel; and by its buoyancy, the air will ascend again through the liquid in bubbles, so as to be passed very effectually in contact therewith, and with the caustic alkali and quicklime, (or with the quicklime,) which is mixed with the water, and which is kept mixed by the agitation occasioned by the bubbling of the air through the mixture. The lime which is thus employed having, by its recent burning, been deprived of carbonic acid, has a strong tendency to absorb carbonic acid; and when the lime is mixed, as aforesaid, with the potash of commerce, which contains carbonic acid, the latter is absorbed by the lime, so as to deprive the potash of its carbonic acid, and render it caustic, and the mixture of caustic potash and lime and water, will, owing to the quantity of lime it contains, or the lime, if that alone be used with water, will have a strong tendency to absorb carbonic acid from the air which is brought into contact with it. The water acts as a medium for bringing the potash and the lime into a state of intimate admixture, in order that the lime may operate on the potash, to absorb the carbonic acid therefrom, and render the same caustic; and also that the mixture of caustic potash and lime, or that the lime, if that alone is used, may operate on the air, which is passed in a current through the mixture of caustic potash and lime, and water, or through the mixture of lime and water, by means of the

bellows, in order to absorb from the air any carbonic acid which that air may contain, and which may be very effectually done by continuing the operation of blowing with the bellows. Wherefore, as fast as the air in the confined place is contaminated by carbonic acid, which is formed by the breathing of the persons who are shut up in such confined place, the air so contaminated being, by action of the bellows, drawn into them, and then forced out from them down into the liquid, will, by the contact therewith which results from the air re-ascending in bubbles through the liquid, have all the said carbonic acid absorbed from the air by the caustic potash and lime, or by the lime; and the air which rises up from the surface of the water will be in a respirable state, as respects freedom from contamination by carbonic-acid gas.

"The operation aforesaid may be carried on during some hours before the absorbent property of the liquid mixture will become so much diminished as to require a renewal of the liquid. With the proportionate quantities of potash and lime and water (or of lime and water) already mentioned, the liquid will last for four hours. The capacity of the vessel wherein the liquid mixture is contained, should be at the rate of about two gallons for each person. The bellows should be of such capacity, and should be worked with such rapidity, as to pass at the rate of about one cubic foot of the air per minute for each person, through the mixture. And note that for each candle, or ordinary lamp, which is to burn in the air contained in the confined place, nearly as much should be allowed of each of the proportionate quantities, hereinbefore mentioned, as would be required for the breathing of one person."

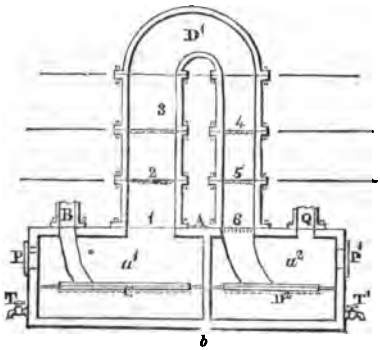
For replenishing with oxygen, places deficient in that vital element, Dr. Payerne proposed to adopt any of four different methods. 1st. To supply it from vessels containing oxygen gas in a high state of compression, in the same way as the Portable Gas Company supplied at one time inflammable oil gas for purposes of lighting. 2nd. To throw from time to time fragments of peroxide of potassium into water, when the extra portion of oxygen contained in it would become disengaged. 3rd. To subject chlorate of potash, or a mixture of chlorate of potash and peroxide of manganese, or peroxide of manganese by itself, to heat, when a like disengagement of oxygen would take place. Or, 4. To fill vessels, as in the first case, with many atmospheres of common air, and to let it out from time to time as wanted. Of these agencies, that of peroxide of potassium seems to have been most in favour with Dr. Payerne; and it was this, we believe, which he made use of in his experiments at the Polytechnic Institution.

We come now to the improvements contemplated under Dr. Payerne's second patent and specification.

And *first*, as regards the purification of vitiated atmospheres. The means formerly used for this purpose were, as the reader has seen, wholly of a chemical character, with the exception of the mechanical contrivances employed to bring the vitiated air into contact with the absorbent mixtures; but Dr. Payerne now proposes, to cause the air to pass also through certain filters or sieves, by which its purification will be still more effectually accomplished. And both these means he has combined together in a new apparatus of his own invention, which is stated to have been used with admirable effect in several of the large hospitals in Paris. A sectional elevation of this apparatus is given in fig 3 of the accompanying engravings; and the following is Dr. Payerne's description of it:—

"I employ an apparatus of the description represented in fig. 3, which is a side elevation in section of the same. A is a box divided into two chambers of unequal size, a^1 a^2, by the partition b, both

Fig. 3.



of which are filled to the extent shown, or thereabouts, with water. In this water

the chemical reagents destined to purify the air are either dissolved or mechanically suspended. B is a pipe, by which the air to be purified is introduced into a^1, the larger of the two chambers of A; it terminates in a float, C, which rests on the surface of the water in a^1, and is composed of fine wire-cloth, through the meshes of which the air, divided into a multitude of thread-like streams, finds its way into the water. D is a bent pipe of two legs, the one of about twice the diameter of the other. The larger leg fits closely upon, and covers an orifice in, the top of the chamber a^1 of the box A; and the smaller one is inserted through a like orifice in the top of the smaller compartment, a^2, and is prolonged till it terminates in a second float, D^2, similar to C. The pipe D consists of six different flanged pieces, marked 1, 2, 3, 4, 5, 6, which are firmly secured together by bolts and nuts; the pieces 1 and 6, which abut immediately on the top of the box A, being secured thereto in like manner. All the joinings of this pipe are, besides, well luted, so that no air may escape through the sides. At the bottom of the larger leg, as also at the joinings 2 and 3, there are inserted gratings or sieves of copper or iron wire-cloth, rendered, by galvanization or otherwise, as little liable as may be to oxidation; and each of these gratings or sieves is covered, to the depth of an inch or two, with moss, interspersed with small pieces of quicklime, or any other substance which is of a like absorbent quality, and not of a nature to generate of itself any gases of a noxious description. At the joinings 6, 5, and 4, of the smaller leg of the pipe D, there are inserted gratings or sieves of fine platinum wire-cloth; and each of these gratings or sieves is covered all over with pieces of spongy platinum. The vitiated air entering, by the pipe B, into the float of the larger chamber a^1, of the box A, and thence into and through the water therein, is there purified to a large extent by the chemical reagents which are dissolved or suspended in the water. It then rises into the upper or vacant part of that chamber, and thence into the pipe D, and through the various metallic gratings, and layers of moss, quicklime, and spongy platinum placed thereon, whereby it is desiccated, and still further purified, the moss and lime serving to absorb any excess of humidity, and the platinum resolving into water any hydrogen which may come over into the smaller leg of the pipe D. On escaping from the pipe D, the air undergoes another and final purification by being passed through the water in the smaller chamber a^2 of the box A, which holds, in a state either of solution or suspension, chemical reagents of the same sort as the large chamber a^1; and rising from out of this water, the air is carried off, in a state fit for respiration, through the pipe Q. P^1 P^2 are doors through which the water and chemical substances are introduced into the chambers a^1 a^2; and T T, cocks by which the water or solutions may at any time be withdrawn."

With respect to the sort of liquid solutions to be employed with this apparatus, Dr. Payerne does not claim to have discovered anything new; but he makes the following useful observations on this part of the subject:—

"The agents most efficacious for absorbing or neutralizing the deleterious matters which are most frequently required to be counteracted, namely, carbonic acid gas, sulphuretted hydrogen, and ammoniacal gas, are the hydrates or oxides of potassium, sodium, calcium, barium, strontium, lithium, magnesium, &c. It is not necessary, however, that these hydrates and oxides should be in a pure state. A cheap absorbent mixture may be made by combining quicklime with carbonate or sulphate of potash, or with the carbonate of soda, in proportions to be determined from analogy by the following rules. Supposing it is desired to make provision for the absorption of the carbonic-acid gas generated by the respiration of one man in the course of one hour, the mixture in the box A should consist of quicklime $1\frac{1}{2}$ oz., carbonate of potash $\frac{1}{4}$ oz., or carbonate of soda $\frac{1}{2}$ oz., and water 1 lb. Or if the sulphate of potash be substituted for the carbonate, then the quantities of water and quicklime should be doubled. In places where the air has become loaded with metallic exhalations which it is necessary to neutralise, as, for example, in smelting works and chemical manufactories, the air must be passed through some liquid acid capable of entering into solid combination with them. Sulphuric acid will generally be

found the most suitable for this purpose, employing it in a more or less concentrated state, according as the product which results from its presence is an anhydrous compound or not. Where the air contains a variety of deleterious matters, requiring different sorts of reagents, the air should be passed through a series of different solutions or mixtures, for which purpose, instead of the two compartments a^1 a^2, there must be three, four, or more provided according to circumstances. For example, there may be one compartment containing an alkaline solution to absorb impurities of an acid nature; a second containing an acidulated solution for the saturation of such substances as ammoniacal gas; and a third, containing a mixture of substances of a compound quality, to serve the purpose of double decomposition. In some cases it may be found advisable to have a compartment specially appropriated to the conversion of carburetted hydrogen gas into water and carbonic acid, and that will be best effected by bringing together in this compartment, out of contact with water, the two conductors of a galvanic battery, which ought to consist of some unoxidizable metal, and be divided at their extremities into a number of threads or filaments, which will render their action more prompt and efficient. I have lately made use of a battery for this purpose constructed in the following manner, and find it very powerful and inexpensive. I insert in a glass vessel another of porous earthenware, fill the first and surround the second vessel with a paste composed of concentrated sulphuric acid and peroxide of manganese; and I put into the second vessel pieces of iron or granulated zink, with weak hydrochloric acid. I establish the communication in the same way as in the present batteries, and use the same sort of conductors."

To cause the vitiated air to flow through the purifying apparatus, it is said that "any suitable blowing or exhausting apparatus may be employed;" but in the case of mines Dr. Payerne recommends the use of an apparatus of a particular construction, which he has lately invented, and describes very fully. It is an ingenious, and, we doubt not, efficient machine; but our present limits will not allow of our doing more than thus generally adverting to it.

Secondly, with respect to the reoxygenating of exhausted atmospheres, Dr. Payerne now recommends, as preferable to all the other substances formerly pointed out, the ferrate of potassium, a new compound lately discovered, we believe, by a M. Fremy, a countryman of his own.

"In the specification of a former patent, granted to William Revell Vigers, of date the 7th July, 1842, for the invention of 'a mode of keeping the air in confined places in a pure or respirable state, to enable persons to remain or work under water and other places without a constant supply of fresh atmospheric air,' which invention was communicated by me to the said William Revell Vigers, several means of generating supplies of oxygen for the purpose were pointed out, which included the best with which I was then acquainted; but I have since then found out that the following is a more economical method. Take any given quantity, say twelve ounces, of the sesquioxide of iron of commerce, and lave it with warm water, until the sulphate of soda contained in it is expelled; then dry it, and heat it to a brown or dark red, when a very pure oxide of iron, in a state of most minute division, will be the result. To one part of this oxide of iron add four parts of dry nitre in the state of powder. Then place the mixture in a crucible of double the sise required to contain it, and lute the neck of it well, leaving only a few apertures to serve as vent holes, and keep it at a bright red heat for about an hour and twenty minutes. The product will be a porous mass of a deep reddish brown colour, which, while still warm, must be broken into small pieces, and transferred as quickly, and with as little exposure to the air, as may be, into well-stoppered flasks for subsequent use. Persons confined in places which are liable to become foul from loss of oxygen, should provide themselves beforehand with one, two, or more flasks of this ferrate of potassium, according to the length of time they are likely to be excluded from communication with the external atmosphere; and as often as they feel any difficulty of respiration from the waste of the oxygen, all that they have to do is to throw a few pieces of the ferrate of potassium into a little water, when a fresh supply of oxygen will be immediately evolved."

In the case of diving-bells, Dr. Pa-

yerne recommends the adoption of *both* the principal methods before described; and he gives drawings (of which the figures on our front page are copies on a reduced scale) of the way in which a bell may, "in his judgment, be best constructed." The following is the Doctor's description :—

"Fig. 1 is a sectional elevation, and fig. 2 a plan on the line Y Z. F F is an outer bell-shaped case, and D D the top cover, with bull's-eye lights, *g g g*. G is an inner case, of the shape of a frustum of a cone, which is fixed at a little distance from the outer one, gradually diverging towards it from the top, till at the points, *h h*, it is closely united with it by a horizontal piece, *n n*. H is a square case, on which the cylindrical and conical parts, F F and G, are placed, and to which they are closely united, so that when the bell has descended to the bottom of the water, the four corners of the square case form open spaces, by which workmen may penetrate into corners not approachable with bells of the ordinary construction. The whole of the space between the two cases, F F and G, is made perfectly air-tight, for the purpose of containing a body of highly compressed air, by means of which the air in the part which is open to the water may be kept in a state of equilibrium with the column of water outside, even when descending to very great depths. As the bell descends, and the water begins to rise in it, a cock, M, in the compressed air chamber, is to be opened, and as much air let out as may be necessary to keep up a perfect balance between the pressure within and the pressure without. J is a pipe, through which this chamber is to be filled before descending, with air, to the amount of two, three, or more atmospheres, according to the depth to which it is intended to descend. K is the cock for opening and shutting the pipe I. M is the cock by which the compressed air is to be let off into the inner case as required. I I is a reservoir where a quantity of compressed oxygen gas may also be kept. N is an apparatus for freeing the air, by absorption as before explained, of the carbonic acid gas, and any other deleterious matter with which it may become intermixed."

BLOWING FANS—HOW TO MAKE THEM LESS NOISY.

Sir,—Observing in No. 1044 of your valuable Magazine, a description of an improved blowing fan, which is stated to have been suggested by the unpleasant noise which they generally make, I beg to inform "X. X.," and your other readers, that the method there given, will not, in the majority of cases, prove a remedy. The noise is chiefly caused by the fan not being properly balanced, as every one may readily prove by trying a small model, in and out of balance. Some time ago, a fan was set to work near the place where I reside, which made so much noise as to alarm the neighbourhood, and be considered an absolute nuisance. Persons considered judges of such matters were called in, and stays, props, bolts, &c., were applied to make it fast to the building and the ground. Still, however, the machine continued to make the same noise, so as even to shake the building. At last a gentleman (whose name is not unknown to your readers) was requested to give his opinion. He caused the fan to be taken out, and, as he expected, he found it considerably out of balance. It was thereupon adjusted, put in its place, and all the props, stays, &c., removed, when it was again set to work, without any of those residing near being aware of the fact: the noise was gone, and with it their complaints. I am, dear sir,

Yours obediently,

T. W. B.

Birmingham, Dec. 4, 1843.

THAMES STEAMERS.

Sir,—Many letters have appeared in your useful Journal with reference to the comparative speed of the *Isle of Thanet* and the *Prince of Wales* steam-boats, the friends of the latter claiming precedence for their favourite, without (I think) showing cause why such claim should be allowed. My object is to call attention to a challenge made by Mr. Napier, when attacked as to "pressure of steam"—"to run against any boat at a *less* pressure than his opponent." To conclude, I am sure, Sir, of your acquiescence in an opinion general amongst people who, like myself, are unknown to Mr. Napier, that the total absence of puff in his operations is well worthy of imitation by many who have not done the state such service as he has. I am, yours, &c.,

AN EARLY READER.

DESIGN FOR A STOVE TO BURN COALS WITHOUT SMOKE.

Fig. 1.

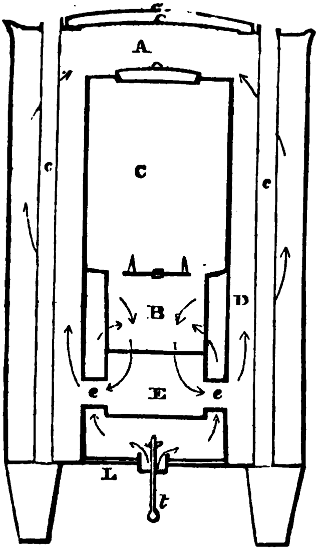


Fig. 2.

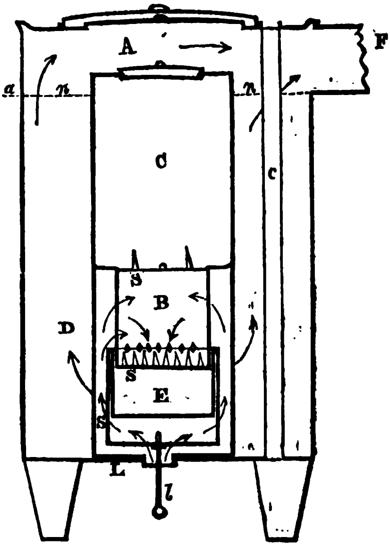
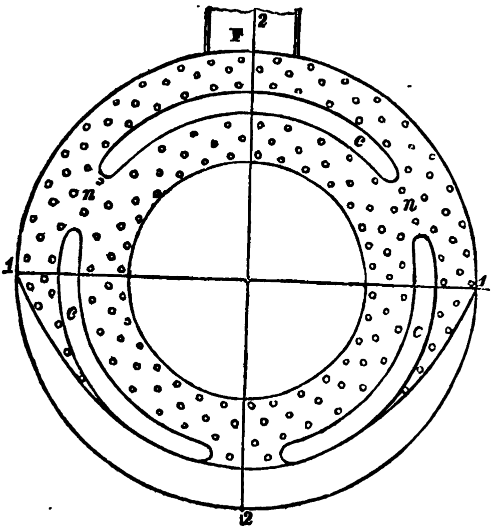


Fig. 3.



Sir,—There is not a more simple and useful form of stove than the "Chunk," described in your No. 851, November 30, 1839; but it is only calculated for burning coke or charcoal. The accompanying design is for a stove somewhat similar, but adapted for burning coals without smoke; and including also a set of pneumatic or

air tubes, like Pope's stove, described in your No. 1034, June 3, 1843. The principle, *i. e.*, of causing the gases of combustion to pass down through the fire and by the bottom of the grate, is derived from the short notice of the Luton stove, which appears in your No. 982, p. 464: but I have not met with a more detailed description of it.

Figures 1 and 2 are vertical sections, and fig. 3 a horizontal or cross section; fig. 1 is a section on the line 1 1; fig. 2 a section on the line 2 2, of fig. 3, and the cross section is on the line *a b* of fig. 2. A is the external case or cylinder with two covers, the outer fitting into a sand or water groove, and the inner accurately resting on the bevelled, or conical sides of the opening—which are made of that shape the better to prevent the chance of any gases escaping into the room. Within the cylinder are fixed the air-tubes *c c c* of thin metal, of the shape and disposition represented in fig. 3, and passing through the top and bottom plates of the cylinder, and communicating with the air of the apartment. Near the top of the cylinder in a line with a lower side of the flue is fixed the perforated plate *n n*, as more clearly seen in fig. 3, the object of which is to cause a *partial* obstruction to the direct passage of the gaseous current towards the flue, and to make it take a direction towards that side of the cylinder which is most distant from the flue before passing into it in the manner indicated by the arrows, fig. 2. The top plate of the cylinder is dished, to contain water for moistening the air by evaporation. In the centre of the bottom plate is a tubulated opening L, in which is placed the regulating valve for the admission of air. The grate B is of a cylindrical form, of open bars, placed angularly or diamondwise, as more clearly seen in the bottom grating fig. 2, (the surrounding bars being vertical, are not seen in section.) The grate is surrounded at a distance of 2 inches, or more, by a close case D, which has only a circular opening in its bottom plate, which loosely fits on to, and surrounds the projecting part of L, which thus forms a support or bearing, to keep the internal cylinder in its place. The ash-box E is also a close case fixed to the bottom surrounding bar of the grate, with two tubular openings *e e*, (fig. 1) passing through the sides of D, and communicating with the external cylinder. C is a magazine for coals, being a close box continued above the grate and fitted with an air-tight cover. All the parts just described, are united together, so as to form one piece or cylinder, which stands within the other, and may be taken out at pleasure, for replenishing with coals and clearing out the ashes; which latter operation is done by allowing them to fall through one of the tubular openings, *e*, held downwards.

It now remains to describe an apparatus connected with the grate for clearing the bottom bars from ashes, and also for stirring the coals immediately above the fire, where they are liable to be caked and form an arch over the fire instead of freely descending into it. The handle *l* (fig. 2) of the regulator, besides its office of turning round the regulator, is capable of a vertical or upward motion, apart from the regulator, and is prolonged above it and formed with a projecting shoulder near the top. The lower cross bar of the *stirring* frame S, is formed with a circular hole in the middle, which goes loosely over the end of the regulator rod, and rests on the shoulder. The side rods of the frame are carried up outside the ash box and then enter between two of the bars on each side of the grate, between which they slide up and down. Pending from them is the ash frame, which consists of a set of narrow plates on edge, placed parallel with each other, and coinciding with the interstitial spaces between the bottom bars of the grate. Above, they carry the frame for agitating the coals, which is merely the top bar, with another (fig. 1) crossing it at right angles in the middle, on which are ranged four spikes equidistant from each other. The frame rests in the position represented in the figures: when used, the handle of the regulator is pushed up, which raises the frame with it, and simultaneously clears the bottom of the grate of ashes, and agitates the coals above the fire, causing them to descend freely into the grate.

The action of the stove is shortly thus: The air admitted through L passes to the grate by the narrow space between it and D; and the gases of combustion, having no other outlet, must pass down through the burning fuel and the bottom of the grate, and off by the tubular openings, *e e* into the outer cylinder, as shown by

arrows. It is plain, therefore, as long as there is a stratum of burning materials in the grate, no smoke can be produced, as the gases will become ignited in passing downwards through the burning fuel.*

I am, Sir, yours, &c.

N. N. L.

December 18, 1843.

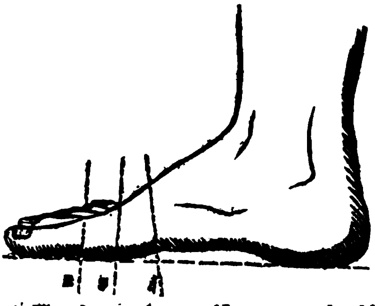
FALSE PRINCIPLES OF SHOEMAKING.

Sir,—In your late Numbers of December the 9th and 16th, are two letters by "Square Toes," and "Henry O'Shaughnessy," on the "false principles of modern shoemaking."

The subject is exceedingly interesting to all classes. To the public at large, from the very great suffering caused by the want of attention to the anatomy of the foot, and of the scientific principles of measuring; and a want of attention, or knowledge of these principles, is injurious to the welfare and interest of our own workmen, as it induces thousands of persons to wear French shoes, and employ French workmen in preference to our own.

As I have paid much attention to this subject, I beg to offer a few remarks, which may be useful to our shoemakers, and beneficial to them, and to the public. There is much truth in the observations made by "Square Toes," but he does not give any particular directions, as to taking the measure of the foot.

By far the best directions I have ever met with on this point, are in Amesbury's "Practical Remarks on Deformities of the Limbs," who gives the following diagram, and rules for measuring:—



"The first and second measures should be taken in the standing posture, with the foot on the ground, because the foot is longer when standing, and the toes spread out. The third and fourth measures should be taken, when the foot is lifted from the ground; and the second, third, and fourth measures, are taken round the foot. The other measures, according to the rules which shoemakers are accustomed to follow. The support of the shoe should be felt by the wearer *above* the toes, and not *upon* them. The toes should have room to move, and not be pressed upon by the shoe in any part."

It is of great consequence that the shoes be made of sufficient length; if the foot be 10 inches, the shoe should be about 11, or 1 inch longer than the foot.

Mr. O'Shaughnessy's remarks are very good, where he observes, that "the beautiful circle of arches, if properly supported, will give full play to the muscles." But I do not think he gives a correct statement of the injury effected by what he terms, "a slip-slop, broad-at-the-extremities-fashioned article, causing an irritating friction, the only and sole cause of corns and bunions." He also says, that, "the largest boots are worn by soldiers and policemen, and they suffer more from tenderness in the feet, than any other class of persons."

There is no doubt, but that soldiers, and the labouring classes generally, suffer from wearing large, or ill-made shoes. But from my own personal knowledge and observation, I can assert, that wearing tight shoes, or boots, is also a very common cause of corns and bunions.

An immense number of men and women in the higher and middle classes of society, and female servants, who generally wear tight shoes, suffer exceedingly from corns. Many of my friends have suffered so much from tight, ill-made shoes, that they now invariably use the "pannus corium," or employ French workmen. I have had drafts of my foot taken on paper, by reputed good shoemakers at the West End, but this was no prevention to the shoes being made painfully tight.

I once spoke to a very intelligent bootmaker on this subject; he said, the English workmen were so very obstinate, they would not attend to his instructions, and the only way "in which he could come over them," was to employ a French cutter-out, and then, and not till then, they would attend to his directions.

It is very desirable that we impress upon our shoemakers, that it is their in-

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* It is scarcely necessary to observe that the coal-box C being close, except towards the fire, no combustion of the coals can take place, or be maintained within it.

terest, as well as their duty, to improve their present mode of measuring, and of making shoes, and not to allow the French artists to beat us in that essential article to our health and happiness—a well-made shoe.

If Mr. O'S. should question the correctness of what I have asserted, regarding tight, or short shoes, producing corns and bunions, I beg leave to refer him to an excellent paper on the subject of "Distortion of the Foot from Pressure," by Mr. Aston Key, in the 51st number of the "Medico-Chirurgical Review."

I am, Sir,

Your most obedient servant,

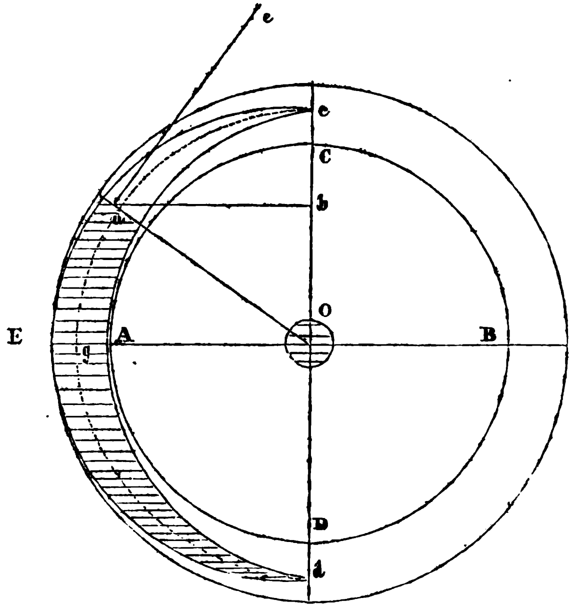
T. E. B.

January 1, 1844.

ROBERTSON BUCHANAN'S PRACTICAL ESSAYS ON MILLWORK.
EDITED BY GEORGE RENNIE, ESQ., C.E., F.R.S.

The following is an extract from this work, p. 326:—

"*Of the proportion of the radius of the wheel to the height of the fall.* Let A C B D be the wheel, and E A the depth of the buckets; then according to experiments on water wheels, it appears that the rotary force of the water in the buckets is nothing at *c* and



d, and that it increases nearly, if not accurately in the direct ratio of the distance from *c* or *d*, and is greatest at A. That is, the force at any point in a direction *e a*, or perpendicular to the radius, is as *a c*.

"A slight consideration of the figure is sufficient to inform us that the wheel will not produce the greatest effect when it receives the water at the upper point *c*, and that there must be considerable advantage in making the wheel of a greater diameter, so that it may receive the water at some point between A and C. The point, which will insure the greatest effect we are now to calculate—Put *c* = that portion of the circumference which is to be loaded with water; and x = the arc, comprehended between the point where the water flows upon the wheel and the horizontal line E A; also make b = the area of the stream supplying the buckets, then the solid which represents the effective force, will be $\frac{1}{2}\,b \times \left(\frac{c^2-2x^2}{c-x}\right)$ which is to be the greatest possible, or $\frac{c^2-2x^2}{c-x}$ = a maximum."

Now, Mr. Editor, by the rule here given, the force at g varies as $c-x$, and that at a as $c-2x$, that is, as the arc

$c\,g$, $c\,a$. Also the pressure at g being as $c-x$, and that at d being 0; the mean pressure on the portion $a\,g$ seems to me to vary as $\frac{c-x+c-2x}{2}=\frac{2c-3x}{2}$, and that on $g\,d$ as $\frac{c-x+0}{2}=\frac{c-x}{2}$. These quantities multiplied by the respective lengths $a\,g=x$, and $g\,d=c-x$ will give $\frac{2cx-3x^2}{2}+\frac{c^2-2cx+x^2}{2}$, the sum of which is, $\frac{c^2-2x^2}{2}$ which, by this mode of reckoning would be proportional to the motive force acting in the whole space $a\,g\,d$; and this multiplied by some constant quantity would give the force itself. But this expression wants the denominator $c-x$, which I confess myself ignorant how to obtain; and as I feel considerably interested in this subject, I should feel much obliged to any of your correspondents for an elucidation of this point.

I am, Sir, yours, &c.

I. O.

ON NATURAL VOLTAIC PAIRS AND THE DISTANCE TO WHICH ELECTRIC CURRENTS MAY BE TRANSMITTED. BY CHARLES V. WALKER, ESQ., EDITOR OF THE ELECTRICAL MAGAZINE.

[From the Quarterly Number for January 1844, of *Electrical Mag.*]

There is a recent* paper by Mr. R. W. Fox, describing the electro-motive power of native minerals associated into a voltaic pair, as they lie in the mine; the experiments are interesting, as being precisely analogous to those already before our readers,† wherein metals have been buried in the earth. Copper and iron pyrites in two separate veins, whose direction was E. and W., and from 14 to 18 fathoms apart, were respectively attached to about 50 fathoms of copper wire; the wire was led to the surface of the earth; and the apparatus for experiment was interposed in the circuit. The permanent deflection given to a rough galvanometer of 48 coils was 14° to 15°; that given to an astatic galvanometer of 140 coils was about 40°: the deflections remained the same, whether contact with the ore was effected by platinum or zink, by a plate or by a point. If, while one pair of ore-points were acting on the galvanometer, another neighbouring pair were formed into a circuit by fresh and independent wires, including the other galvanometer, the deflection of the first galvanometer was reduced, and that of the second attained a few degrees less than its ordinary angle; but, when either circuit was interrupted, the standard maximum deflection was regained. Both wires connected with one galvanometer did not increase its deflection. When a pair of zink and copper, excited with moist cloth, was interposed in the circuit, so as to generate a current *co-incident* with that from the earth, the deflection was reduced several degrees; when the interposed pair was placed so as to act *counter* to the original current, the galvanometer at times returned to zero, and sometimes passed that point. A separate examination showed a deflecting power in favour of the mine over the pair of zink and copper. When a horse-shoe electro-magnet was included in the circuit, and contact was made and broken alternately, a compass-needle was caused to oscillate in an arc of 70°. A solution of hydriodate of potash was decomposed, after being included for rather more than a day. When sulphate of copper was placed in each arm of a U tube, having a porous clay tamping, and the circuit was kept closed by silver wire for a few days, the endosmose action raised the column connected with the negative wire one-eighth of an inch, whilst the other column was lowered to an equal degree. When copper pyrites was used instead of wire, that piece contained in the negative cell in two or three days had its surface gradually changed to vitreous copper. This also occurred when carbonate of soda, or when common salt was substituted for the copper solution. When several weeks of action were permitted, oxide of iron was occasionally found on the negative pyrites. An engraved plate and a sheet of copper were placed in a solution of sulphate of copper and connected with the respective wires of this native pair; after an action of nearly two months, *an electrotype copper-plate $1\frac{1}{4}$ inch long, $1\frac{1}{4}$ in. wide, and $\frac{1}{80}$ in. thick*, was obtained, to use Mr. Fox's words, *Vi Insitu Terræ*. When one wire was in contact with *ore* in one vein, and the other wire touched the *rock* in the other vein, feeble currents passed, owing, no doubt, to the moisture of the rocks. The action was most decided when the place of contact with the rock was near the ore. Several times, on rubbing the wire against the wall of one of the veins, or the sides of a "cross cut," sudden increased deflection occurred; and, when the spots where this was observed were afterwards broken away, iron pyrites was invariably found imbedded there; "and," as

* Vide also Proceed. Geol. Soc., June 1, 1842; and Tenth Report Cornwall Polyt. Soc. p. 103.

† Vide *Elec. Mag.*, No. 1. p. 52.

Mr. Fox remarks, "there can be no doubt that the smallest branch of copper or lead ore might have been detected in like manner." When both wires were in contact with the respective rocks, the currents were too feeble to be depended on.

The above interesting experiments appear to reduce themselves under the same general law which regulates all voltaic action: the two veins containing, as they evidently do, ores holding different ranks in the electric scale, represent the two plates of a voltaic pair; the moisture of the earth, and the water, which is described as flowing into the mine, is the exciting liquid. The distance between the elements, 100 feet, reduces, but does not destroy, the electro-motive power. Mr. Bain's experiments in Hyde Park are confirmations to these; they all reveal to us a great extension of the limits within which we have been willing to consider that electro-motive power is confined. Mr. Fox says, "I have long ago seen a *very feeble* current act on a sensitive galvanometer after it had traversed nearly a quarter of a mile of strata; and stronger currents would probably be detected in like manner, after having passed many times that distance under the surface." Mr. Kemp generated a current with a voltaic pair, the plates of which were several hundred feet apart: Mr. Bain at the distance of a mile. But, as all known phenomena convince us that the power is reduced as the distance increases, we must hesitate before we accept the inference thus expressed by Mr. Finlaison: "If a copper wire, one-sixth of an inch in thickness, be imbedded in a bar of boiling asphultum, and sent along the railway (for its better protection,) from London to Liverpool—if two tons weight of zink plates be immersed in the Mersey at Liverpool, and attached to that end of the wire, and if one ton weight of copper be sunk in the river Thames, and attached to this end of the wire, no rational man can doubt that an electric current would be established of ten times the power necessary to work a telegraph."* We have strong doubts on this point: and are inclined to think the 200 miles, above named, as very far exceeding the limits of the available action of any pair of metals. It is not because recent researches have extended the limits from yards to hundreds of yards, that we are henceforth to ascribe no bounds to the action; on the contrary, the very feeble effects produced at the comparatively small distances before us teach us to expect that not only would no available action occur at great distances, but scarcely any action at all.

To return to Mr. Fox's experiments. The electro-motive minerals, by laws familiar to electricians, suffer chemical change in proportion to the electric development; and in the case before us they are put into condition to effect that development by the *artificial* application of the copper wires. It only remains to conceive some *natural* substitute for the said wire, to have an insight into the secret workings of the laboratory of nature: this substitute is present, from the very disorder, as it at first appears, of the earthy strata; and thus, what to the casual observer seems "discord" is, in truth, "harmony not understood;" it is the very means adopted by nature to elaborate in the womb of the earth those many productions which have become so essential to the happiness of civilized man. Moreover, as all voltaic effects are attended by an equivalent chemical change in the materials of the electro-motor, it incontrovertibly follows that such effects will last no longer than the generating elements remain; and that these elements will, independently of local action, be changed in proportion to the electricity generated. Yes, and some of these changes, as, for instance, the formation of oxide of zink on a zink plate, may very soon operate in reducing the original electro-motive power of the pair; indeed, this *has* actually occurred in some experiments made by a friend of ours; so that, although our views of the distance which may intervene between the generating plates of a voltaic pair, have been extended by the recent experiments to which we have alluded, we are physically sure that the author draws a false inference, who says, "that by placing plates of positive and negative metallic surfaces in the earth or in the water at great distances; then connecting these by a well insulated wire, he is enabled to discard galvanic batteries altogether, and to produce an everlasting and unvarying flow of electricity, proportionate in power to the amount of metallic surface." It cannot be "everlasting," for it is limited in quantity and duration by the mass of the positive metal; it cannot be "unvarying," for it suffers a gradual decay by the gradual consumption of the same metal. C. V. W.

* Vide Mr. Finlaison's Book, p. 34.

HEATING THE CUSHIONS OF BILLIARD TABLES.

Sir,—The interest and fascination of the game of billiards have been greatly increased by the adoption of the slate beds, and the India-rubber cushions. The latter are, however, open to objections, which it is my object to suggest, materially, the removal. The cushions r-

most sensibly affected by cold, and the present process of airing them is long, troublesome, not perfectly effectual, and causes injury to the cloth and table. These are serious objections, particularly in private houses, and where there is not a person specially to look after the table. The remedy I propose is, so to construct the table and cushions that a metal tube should ramify through the latter, into which hot water could be poured with a common tea-kettle.

Very little mechanical and hydraulic ingenuity would effect this, the advantages being, that the cushions would be aired with ease and promptitude, and equally too, and the cloth and cushions would not be worn and stained as they are by the clumsy contrivance now in use.

J. B.

TO PREVENT STEEL PENS FROM CORRODING.

Sir,—The above evil may be easily prevented by a simple, and at the same time cheap process, which I have adopted. The process is as follows: cover your steel pens with gold or silver by the electro-gilding process, which will render them incorrodible; or, make a solution of gold by means of two parts of muriatic acid, one part of nitric acid, and as much ether, afterwards added, as may be necessary, which will give a perfect coating of gold to your pens, and prevent the annoyance which your correspondent "G" complains of. By inserting this in the *Mech. Mag*, you will oblige many of your readers who use steel pens. I am, Sir,

Yours, &c.,
THOMAS FULLER.

January 1, 1844.

ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

WAKEFIELD PIM, OF KINGSTON-UPON-HULL, ENGINEER, *for certain improvements in the construction and formation of buoys or other water-marks.* Patent sealed March 18; Specification enrolled, September 18, 1843.

The buoy is externally of the ordinary construction, but the lower, or submerged half, instead of being entirely closed to the water, as usual, is open half way up, where a bottom is inserted, on which the ballast is placed. The effect of this arrangement is, that the quantity of ballast required to steady the buoy is reduced to about one-third, and that the buoy floats much higher out of the water, and can consequently be seen at a much greater distance. Just below the bottom plate there are orifices in the sides of the buoy for the escape of any air which may be forced upwards by the water, so that the portion left open may, at all times, be completely filled.

A most judicious and useful improvement.

JOHN MICHELL, OF CALENICK, CORNWALL, TIN SMELTER, *for improvements in extracting copper, iron, lead, bismuth, and other metals or minerals from tin ore.* Patent sealed, April 11; Specification enrolled, October 11, 1843.

The tin ore is to be pulverized as heretofore, and the greater portion of the matrix separated by washing. The ore is then to be calcined and treated with muriatic or other acid, in order to dissolve the foreign metals or minerals, when such foreign metals or minerals, consisting generally of small quantities of copper, iron, lead, and bismuth, being so dissolved, may be readily washed off and separated from the tin ore. The best time of submitting tin ores to the action of acid is whilst they are warm, after removing them from the calcining process. The acid should be diluted with about an equal quantity of water, and such diluted acid either poured on to the ores, or the ores may be gradually thrown into the diluted acid. The tin ores are to be allowed to remain three or four days, or a longer period if necessary, subject to the action of the acid; the time, however, during which the ores are submitted to the action of acid is considered not to be material, so long as sufficient time is allowed for the purpose. The quantity of muriatic acid required is about 1 cwt. of the ordinary acid of commerce for each ton of ore; but in some cases a larger proportion of acid will be necessary. Where the foreign metals are in a state of oxide, it is said not to be absolutely necessary to calcine the ores before operating with acid. The process of dissolving the foreign metals or minerals being completed, the ores are well washed in water, by which the dissolved metals or minerals will be extracted or separated from the tin ore. In some cases it may be expedient to apply heat in order to hasten the process and lessen the quantity of acid. This may be effected by putting the ore with the acid into earthenware vessels, which may be placed in a sand-bath.

What the patentee particularly claims is "the mode of purifying tin ore by extracting foreign metals or minerals, by dissolving them in acid, and washing them off or separating them, as above described."

MOSES POOLE, OF LINCOLN'S INN,

Gentleman, *for improvements in the deposition of certain metals, and in apparatus connected therewith.* Patent sealed, May 25; Specification enrolled, November 25, 1843.

The processes which form the subject of this patent, and which have been communicated to the patentee from abroad, are thus described :—

Silver Solution.

"I dissolve 1 lb. troy of silver in nitric acid, and dilute with 1 gallon of water, precipitate the silver, by adding a solution of carbonate of soda (in water) of 100° Fahr., (1 lb. of carbonate of soda is sufficient, if the nitrate of silver contains no free acid.) I wash the precipitate with warm distilled water, and filter. In another vessel I dissolve 8 lbs. of hyposulphite of soda in 2½ gallons of water, at 100° Fahr., or thereabouts, and add thereto 1 lb. of carbonate of soda with the precipitated carbonate of silver, stirring the same until the silver is re-dissolved, which will be the case in a few minutes, and filter the solution, which will then be fit for use.

"Note.—In practice I have found it advisable that the solution contain free hyposulphite and carbonate of soda; and for this purpose I add 1 lb. avoirdupois hyposulphite, and ⅓rd lb. of carbonate of soda, in proportion to every pound troy of silver that may be deposited.

"Note. — In place of hyposulphite of soda, hyposulphite of potash may be used in the proportion of 5 lbs. of hyposulphite of potash, to one pound of silver in the state of carbonate; and in working the same, I add 6 ounces of hyposulphite of potash, and 5 oz. of carbonate of soda to every 1 lb. troy of silver deposited therefrom.

Another Mode.

"I prepare a solution of silver, as above, and boil the same for one hour, during which time a portion of silver is precipitated, and the hyposulphite changes, forming a new and distinct salt. The solution is filtered, and is then fit for use.

"In both the above cases currents of electricity are used when depositing.

Gold Solution.

"I dissolve 1 oz. troy of fine gold in nitro-muriatic acid, and evaporate the solution until it assumes a deep red colour, and crystallizes upon cooling. I then dilute the remaining solution with one pint of distilled water, and filter; I then heat the clear solution of gold to about 200° Fahr., and precipitate the gold by adding a solution of liquor ammoniac; I then pour the precipitate gold upon a filter, and wash it several times with hot water; I then dissolve this precipitate of gold in 1 gallon of water, containing 8 oz. hyposulphite of soda, or an equivalent quantity of potash, and boil the same together for one hour; I then filter the solution, and it is fit for use. During the process of gilding, I prefer to warm it to about 100° or 150° Fahr. In using the above, I employ a small anode of gold, say about one-tenth of the size of the article to be gilt, and a current of two pairs of plates, (if I employ the ordinary galvanic battery;) but this effect may be varied by altering the power of the battery and the size of the anode at the pleasure of the operator.

Copper Solution.

"I dissolve 1 lb. carbonate of copper in 8 lbs. hyposulphite of soda, (or an equivalent of potash,) and 1 lb. carbonate of soda dissolved in 2½ gallons distilled water at 100° Fahr., or thereabouts, and filter to obtain a clear solution. It is then fit for use with currents of electricity, and I prefer to use it at 100° Fahr."

The "apparatus" to which the patentee refers in the title of his patent is the battery for effecting the precipitation of the metals. He calls his improved edition of it a "Thermo-electrical battery," and describes it as follows :—

"I take one hundred pieces of German silver, containing twenty to twenty-five of nickel, and one hundred pieces of iron, every piece being 1 inch wide, and 1 foot long, and ⅛th of an inch in thickness. These two hundred pieces are soldered so to each other, that iron is always combined with German silver. To get a compact form, I arrange, first, ten rows, every one of twenty pieces, or ten pairs, and solder these rows so to each other, that they are parallel, and the whole take the form of a square, taking care that the several pieces are soldered together in such a way that iron will always be in connexion with German silver. When the whole is united, I place it into a rim or frame of iron plate, 1 foot 2 inches high, but so that the metals do not touch each other, nor the iron rim or frame, and fill the rim with plaster of Paris or clay, but so that all soldered parts of the series of plates or bars are uncovered, that is, the under ends 1 inch, and the upper ends 3 inches. The clay is covered at the surface with a layer of pitch. The frame containing the series of bars or plates is so placed that the lower ends of the series (1 inch) dip into a sand-bath, which is heated nearly to redness by the fire; the upper ends (3 inches) are to be kept as cold

as possible, and for this purpose I cause a current of cold water to flow from out a vessel over the battery, to another vessel; the upper end of the metals (3 inches) may be covered with lac or varnish. I have found this battery sufficient for general purposes, and probably one formed of fifty pairs only would answer the purpose when small articles only are required to be coated."

JOHN TAPPAN, OF FITZROY-SQUARE, GENTLEMAN, *for certain improvements in apparatus applicable to flues or chimneys, for the purpose of increasing the draft therein, and promoting the combustion of fuel.*—(Communicated by a foreigner residing abroad.) Patent sealed, May 30; Specification enrolled, November 30, 1843.

In supplying air to furnaces to promote combustion, the usual practice has hitherto been to introduce it somewhere near to the fire, as into the ash-pit, or beneath the fire-grate; but Mr. Tappan's foreign correspondent thinks a better effect is to be obtained by causing the air to ascend by means of a blowing machine, and a pipe leading from it, into an air receiver placed in the centre of the discharge flue or chimney, in the midst of the smoke, and other products of combustion. "When a powerful current of air," says the specification, "is thrown by the blast apparatus through the pipe into the chamber, it will rush out of the top of the chamber, and coming into contact with the ascending column of heated air, smoke, or gases proceeding from the burning fuel of the furnace, will discharge the same from the chimney, thereby creating a powerful draft up the chimney and through the combustible matter of the furnace." True, the "draft" will be thereby increased, but the patent is for "promoting the combustion of fuel" as well; and for that purpose a cubic foot of air passed through a fire will be worth a hundred sent into the chimney.

NOTES AND NOTICES.

A Floating Railroad.—A Cincinnati correspondent of the *Newark* (U.S.) *Morning Post* says:—"I was recently invited to witness the operation of the model of a machine (for boat it could not be called,) to navigate our inland water. The inventor is a young man of this place, and, as is usual in such cases, is very enthusiastic in his expectations of its capabilities and powers. He says that the passage hence to Pittsburgh (500 miles) can easily be performed by daylight. It may very properly be denominated a floating railroad, or a railroad which lays its own track, and takes it up again when the passage over it has been made. It may be thus described; a series of oblong, air, and water tight sections of any required length, breadth, and depth are firmly secured side by side, upon an endless chain; this chain is distended to its utmost upon a series of cast-iron wheels, supported by shafts, upon a suitable frame-work. These wheels are put into motion by means of the steam engine. The frame-work, with its engine, boilers, and wheels, may be called the locomotive; the chain, with its floating power of water-tight sections, the railroad. When it is placed upon the water, and the engines are put into motion, the endless chain, or railroad, traverses the surface of the paddles or wheels, by which the sections upon the chain, in succession, are carried forward and enters the water, each doing its part in supporting the whole fabric, and are again taken up in their endless round in the stern wheels. One very novel characteristic of this machine is, its adaptation to either water or land, so that it need not be retarded by sand-bars or low water. This is obvious when it is observed, that the floats or sections during the time they are beneath the frame-work (and of course supporting the whole) do not advance at all, but remain stationary, while the wheels pass over them: when they leave the water or land, however, they go rapidly forward to redeem their places on the forward part of the craft, and to bear up the structure. Upon the frame-work which supports the engine, &c., and above the chain and floats, the cabin for the accommodation of passengers is to be erected. That this thing will move rapidly through or over the water, I have no doubt, but think the enthusiastic inventor has over estimated its powers; or set too low an estimate upon the resistance it will meet with, from the element through which it is to pass."

Jeffery's Emergency Boat.—Mr. Jeffery, the inventor of the marine glue, attended last week at the Woolwich dockyard, to show the facility with which that substance might be used in cases of shipwreck or dangers at sea, and in the construction of conveyances for men and ammunition, or other stores, across rivers when engaged in warfare. The experiments took place in the presence of Colonels Paterson, Lacy, and Turner, Brigade Major Cuppage, Captain Bullock, &c., &c. Mr. Jeffery and his assistants commenced operations by unfolding several pieces of wood about an inch think, joined together with hinges, and appearing like a folding fire screen. Several smaller pieces were then attached with hooks and eyes, and the composition applied to the joints, and in 20 minutes a boat 12 feet long, 4 feet broad, and 20 inches deep, was constructed and launched, having an air-tight space in the stern of 2½ cubic feet, and a similar air-tight space of 15 cubic feet in the fore part for rendering it buoyant. Immediately on its being launched Lieutenant Nicholls, commanding the *Dwarf* steam vessel, Mr. Jeffery, and two workmen, went on board, and were rowed to the *Hebe*, receiving vessel, stationed in the middle of the river, and returned on shore, the whole time from unpacking the pieces of wood to the end of the experiment only occupying about 35 minutes, and the vessel was taken on shore by two men without having leaked one drop of water. On being weighed at the machine it was found to be 2cwt. 7lbs. Mr. Darling, from Devonport, who was sent from that dockyard to receive instructions in the application of the marine glue, superintended the construction of the boat; and although it was the first time the experiment was tried, it answered satisfactorily, and afforded evidence of the simplicity of the application of the substance, and the uses to which it might be made an important auxiliary in cases of emergency.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1066.] SATURDAY, JANUARY 13, 1844. [Price 3*d*.

Edited, Printed and Published by J. C. Robertson, No. 166, Fleet-street.

MESSRS. LEWIS AND CO.'S OMNIDIRECTIVE SHOWER BATH.

Fig. 1.

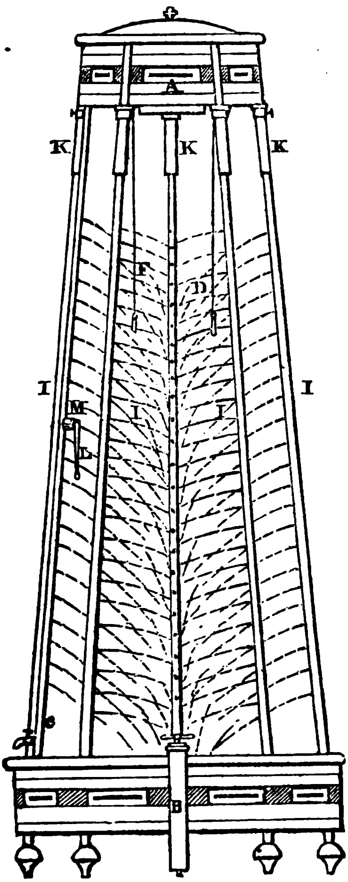


Fig. 4.

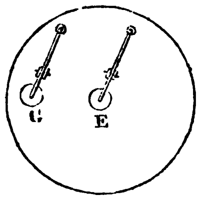


Fig. 2.

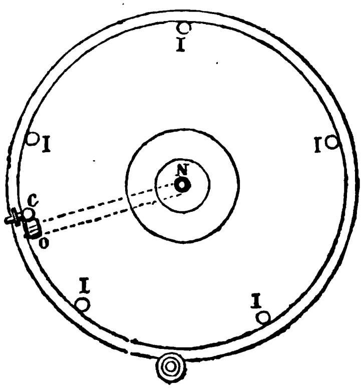


Fig. 5.

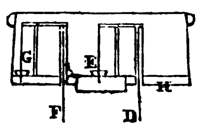
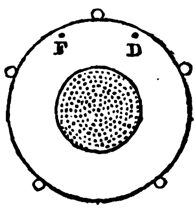


Fig. 3.



THE OMNIDIRECTIVE SHOWER BATH. MESSRS. LEWIS AND CO., OF STANGATE-STREET, LAMBETH, PROPRIETORS.

Registered under the Act for the Protection of Articles of Utility.

The engravings on our front page represent an improved shower bath, which has been recently invented by Messrs. Lewis and Co., bath manufacturers. It is one of the most complete things of the kind we have ever seen, and must greatly extend the usefulness of this already most useful article.

Fig. 1 is an elevation of this shower bath; fig. 2 is a plan of the bottom of the bath; fig. 3 is a plan of the top or cupola, looking at it from below; fig. 4 is an inside plan of the top or cupola; fig. 5 is a section of ditto.

A is the cistern; B is a hand pump, by which the water is forced up into the cistern through the pipe *c*; D is a string, by pulling which, the valve E (fig. 5) is lifted, and the bath acts after the manner of the common perpendicular shower bath. F is another string, by pulling which, instead of D, a second valve G is lifted, and the water in the cistern flows into the chamber H, whence, on opening the taps at the top of the several hollow pillars I I I, it passes down these pillars, which, being perforated with a number of small holes on the sides next the centre of the bath, the water is projected through these holes in a number of lateral streams on the body of the bather. At bottom these pillars are closed. K K K are circular slides, one to each pillar, by bringing which down to any particular level, the holes all round, for a breadth corresponding to the length of the slides, may be stopped up if required; as for example, those opposite the face may be stopped and the rest left open. Or, instead of the whole of these slides being brought down together, one or two only may be brought down, and particular parts of the body be thus shielded, on which it is not desired that the streams of water should operate. L is a branch pipe, with a rose at the end, which is attached by a universal joint to the pipe *c*, so that it may be directed by hand towards any part of the body, and (the tap M being opened) a strong stream of water be projected upon it. N is a pipe in the centre of the bottom of the bath, which has a communication with the pipe *c*, which may be opened or closed by the tap O; when the communication is open, water rushes from the pipe *c* into the pipe N, and is projected directly upwards to a considerable height.

By the different contrivances which have been thus described, the water in the omnidirective bath may be projected on the body in any direction, and on the whole, or only on parts of the body, as may be desired.

THE SLIDING RULE.

Sir,—The communication of your correspondent "J. M.," at page 458 of last volume, induces the enquiry, why his formulæ are referred solely to "Aston's Slide Rule"? As far as can be gathered from the paper, there is nothing in these formulæ that is not equally applicable to the common rule of Coutsall, or Cook, or Hobcraft, or any other maker.

Mr. Aston is, I believe, a rule maker at Birmingham, and as good as any other, for aught I know; but if there be any *peculiarity of construction* in his rule, referred to by "J. M.," it does not as yet appear.

For the use of our mechanics, some means of producing *better divided rules* without enhancing the price—is a desideratum. I have thought of two methods.

1. By transferring all the divisions at once from a steel pattern by simple pressure. There are two ways of making this pattern. First, by Perkins and Heath's method of taking an impression in soft steel from a previously deeply engraved pattern It is, however, to be apprehended, that the unequal effect of temperature on the metal in the process of hardening would impair the accuracy of the divisions. Secondly, by putting together the pattern with steel sharp-edged rules separated by steel quadrats, after the manner of type composition. The thickness of the quadrats must be adjusted by grinding to the utmost nicety, so that the formation of the pattern would be very tedious. Yet there might be an immense number of rules copied from it, at a most insignificant expense.

2. By means of a self-acting dividing engine, having its circumference logarithmically divided by angular notches. The circular motion of the great wheel to

be converted into a longitudinal one of the cutter by a flexible steel band, adapted to different sized cylinders on the axis of the wheel. The first cost of such an engine would be great, but not greater in proportion to the value of the article made, than is frequently found in other manufacturing machines.

J. W. Woollgar.

Lewes, January 4, 1844.

CLAIM TO THE DISCOVERY OF A MEANS OF DIRECTING BALLOONS.

Sir,—As the subject of aerostation is at last exciting considerable interest, and as the public appear now prepared to believe in the possibility of its accomplishment, I feel anxious, through your valuable journal, to record my claim to the priority of the invention of giving to balloons a specific direction, and that by the aid of steam, before I shall be eclipsed by a host of imitators. When I say imitators, I do not mean you to understand that any of the plans which have been mooted resemble mine, for, with the exception of Mr. Mason's, every one hitherto proposed has been about as applicable to the purpose as it would be to attempt to guide a vessel in the middle of the Atlantic, by turning the vane at the mast head. I doubt much whether even Mr. Mason's will effect the object in view. You never can navigate the atmosphere without some buoyant power in the first place to float you there,—a *point d'appui*, as it were. If Bell or Fulton, or any of the illustrious men of genius, who first applied the power of steam to vessels had argued thus,—'we shall not have a ship which floats on the water whether in motion or not,—we shall have merely a raft, which will cut through the water at a much quicker rate, *as long* as the propelling power is kept up, but no longer,' where would steam navigation have been now? Should we have been crossing the Atlantic in twelve days? Would our government now be fitting up steamers for maritime warfare? Would every sea and river in our quarter of the globe have been at this moment traversed by steam-boats of every size and capacity? I trow not! Here, then, is the balloon, which is to the air, what the ship was to the water. Give that a specific direction, and you have aerial navigation of the most splendid kind!

It is upwards of ten years since I fully accomplished this, as can be proved by incontrovertible evidence,—letters addressed to several of the principal aeronauts in Europe, with the view of bringing it out under their auspices. It is two years since I offered to the British government to convey the mails and passengers across the Isthmus of Suez, which I will engage to do at the rate of fifty miles per hour with the wind, and ten miles an hour against it, in moderate weather, and as the distance in a direct line is only seventy-five miles, it could be accomplished in two hours and eight hours accordingly, at infinitely less expense and personal risk. I am at this moment negotiating to convey an expedition to explore the North Pole, and to ascertain the existence of a north-west passage, and I am convinced that this is a much more rational method, than dog sledges and boats drawn by men advancing three miles an hour. If ever it is reached at all, it will be by means of a balloon as first suggested by me. From these considerations, I have determined shortly to issue a prospectus for raising a Joint Stock Company, with a capital of 100,000*l.* in 20*l.* shares, of which due notice will be given, and as a large premium is offered by government for reaching the North Pole—as the capital may be doubled every year, by merely carrying passengers from London to Edinburgh, and from London to Paris—what a profitable investment would it be if they should add the mails, which would follow as a matter of course.

I am, Sir, your obedient servant,

John Henderson.

Edinburgh, 76, Clerk-street, January 6, 1844.

THAMES STEAMERS—THE "PRINCE OF WALES" AND "ISLE OF THANET."

Sir,—In matters of fact the statement of an eye-witness naturally carries a greater weight than any other sort of evidence, and when your correspondent Mr. Henry Osmond, who "*is in no way connected with either of the vessels,*" contradicts the statement as to a trial of speed having taken place between the

Prince of Wales and the *Isle of Thanet*, on the 25th of August last, *on which day he was himself a passenger*, it really requires no ordinary amount of scepticism to disbelieve the averment.

It would seem, however, that he is fully aware of the universally acknowledged difficulty of *proving a negative*, since, after having flatly contradicted the statement, he proceeds to show how in his opinion no such trial could have taken place.

Now as Mr. Osmond professes to "*feel a great interest in the subject*," and is apparently very anxious to arrive at the truth, he will no doubt be gratified to learn not only that a trial did take place, and that on the very day in question, but that, having been on board the *Prince* on that occasion, I employed myself in "takin' notes," though at the time I had little idea that I should "prent" them. As these notes were not taken for any party purpose, but simply for my own information as to the actual speed of our first-rate steamers, you may rely on their correctness.

From these notes it appears that the *Prince of Wales* left Blackwall on the 25th August, at 20 minutes past 12 to resume her station at Margate, and after having made several trials of her speed at Long Reach, (an excellent practice, by the way, and one which if more generally followed would prevent many absurd opinions from passing current,) had resumed her route towards her destination; but as on her way thither the *Isle of Thanet* was descried ahead, coming up the river, it was resolved to take this opportunity of testing the comparative speed of the two vessels.

The *Prince of Wales* was, therefore, turned round, and awaited the arrival of the *Thanet*. At 2 h. 39½ m., the two vessels were exactly abeam, and it was soon evident that the *Prince* had decidedly the advantage in point of speed, having gained upon her opponent from the very commencement of the race. At 2 h. 59 m. we rounded a collier brig, moored nearly in the middle of the river, just above Purfleet, and took a fresh course for the next reach of the river. At 3 h. 2¾ m. the *Thanet* rounded the same brig, which was evident to us by her change of course. At 3 h. 6½ m., being quite satisfied with our victory, we commenced to turn round, being at the time within half a minute's run of Cold Harbour Point, which point, in fact, we passed a few seconds later; these odd seconds having been allowed at the time as a compensation for the loss of way caused by turning. At 3 h. 8½ m. we had effected our evolution, and were again on our way towards Margate; and at 3 h. 9¼ m. we met the *Thanet* coming up. At 3 h. 12½ m. the *Thanet* reached Cold Harbour Point, which we should have reached, as before stated, at 3 h. 7 m. had we not turned a little too soon, thus beating the *Thanet* 5½ minutes in 33, as stated by "Veritas."

It appears from these memoranda, 1st. That the *Prince of Wales* WAS tried against the *Thanet* on the 25th of August; and 2nd, that the statement of your correspondent "Veritas" as to the time is strictly correct; or, in other words, that on the occasion in question the relative speed of the two vessels was in the ratio of 6 to 5 nearly, as proved by the total run, and confirmed by the intermediate observation of the times of passing the brig.

These facts may be explained in any way parties may like best; and it would certainly be cruel to deprive the vanquished party of any construction that may afford them the most consolation; but lest any one should seek the cause in the supposed superiority of performance of the *Prince of Wales* on that occasion, I beg to inform them that, owing to fresh packings, and other causes, the performance of the engines was that day so much under the usual standard, that the number of strokes never exceeded 30½, whereas, with the same diameter of wheel, the engines have often made, in regular working, 32.

After this plain statement of facts, as they came under my own observation, it remains only to be enquired, how Mr. Osmond's "eyes were holden so that he could not see" what must have been visible to the crew and passengers of both vessels, and consequently to himself, if, as he states, he was a passenger on the day in question.

Respecting as I do his straightforward manly way of coming forward with his real name, instead of skulking under an incognito, I hope he will be able to assign a reason why he missed a sight that

to him must have been peculiarly interesting, as it would at once have enlightened him on a subject to which he has evidently devoted much attention. Has he mistaken the day on which he was a passenger? or was he at the time better employed on board?

In either case, I hope he will admit he has been too hasty in contradicting the statement of your correspondent "Veritas," which (although anonymous) is strictly true, which is more than can be said of the generality of statements to which parties, for obvious reasons, are ashamed to fix their real names. Hoping that his practice and my own, in this respect, may in future be more general amongst your correspondents,

I am, Sir,

Your obedient servant,

JOHN BARNES.

Blackwall, Jan. 9, 1844.

Sir,—Will you favour me with the insertion in your next Magazine of a few words in reply to Mr. Osmond's request for information on the short run which the *Prince of Wales* and the *Isle of Thanet* Thames steamers had in August last, as stated in a previous letter of mine. Mr. Osmond will find, if he will take the trouble to enquire, that on the day in question the *Prince* did not leave London Bridge at the hour he names, say 10 A.M.; but ran down in the after part of the day to Margate, to be ready for taking her station there on the following morning, and was at Grays when the *Thanet* came up, and gave her a run back to Erith, which was performed by the *Prince* in 27½ minutes, and by the *Thanet* in 33. It is true the *Prince* had no passengers, nor had the *Thanet* a great freight, and Mr. Osmond can make what deduction he pleases on that score. I must further inform Mr. Osmond that it is not greater fitness that continues the *Herne* running at this season; the interests and desires of the respective companies determine this point; nor will the slightness of build, or weight of machinery, of the *Prince* prevent her hereafter beating the *Thanet*. Mr. Osmond is also in error when he states that nothing had been done in the past year for velocity. The fastest boat afloat on the Thames, the *Prince of Wales*, is the production of that year, and will probably continue to be the fastest until eclipsed by some new *sans-pareil*.

I remain, Sir,

Your obedient servant,

VERITAS.

January 9, 1844.

ON IRON WATER-TIGHT BULKHEADS.

BY C. W. WILLIAMS, ESQ., LIVERPOOL.

[From the Parliamentary Report on Steam Vessels.]

A desire to lessen or prevent those accidents to which ships are liable at sea, has long engaged the labours and attention of humane and scientific men; and, when we consider the fragile nature of a ship, as compared with the tremendous force of the sea, and that a single plank is all that is interposed between that element and those on board, we are tempted to express our astonishment, not that so few vessels are lost, but that so many escape.

The casualties to which ships, particularly steam-ships are liable, arise, for the most part—first, from striking against or coming in forcible contact with rocks, or such solid bodies as would injure the framework of the vessel; and, secondly, from accidental collision with other vessels, by which some part of one or both vessels become so damaged as to admit the water to such an extent as to overcome the power of the crews to pump it out.

Ingenious men have endeavoured to devise expedients for lessening the risk consequent on such damage. Among these was the introduction of air-tight tubes to such an extent as, in case of the body of the vessel being filled with water, should give it so large a buoyant power as to keep the vessel afloat. A patent was obtained for this invention, and an ingenious tract published, demonstrating the protection which a given number of tubes, distributed throughout the vessel, would afford. It does not appear, however, that the practicability of stowing away a sufficient quantity of those tubes or air vessels was ever tested, or that a vessel of any magnitude was so fitted as to demonstrate its utility.

That any expedient shall be discovered which will prevent the irruption of the water to an extent beyond what may be within the power of men and pumps to expel is a hopeless case. Even in the event of running on an anchor or other body, which should break any part of the ship's bottom or side, or of a single plank starting, the extent of the injury would most likely be such as to render it impossible to keep the vessel afloat by human power. It occurred to me, that the only practicable expedient for preventing the sinking or actual submersion of the entire vessel would be, by confining the effect of the injury sustained to that portion or section of the vessel in which the injury occurred; and this is the basis of the plan I am now to submit.

Hitherto, nothing has been attempted which could prevent the water, in case of breaking in, from collision or other cau

from passing at once throughout the entire body of the vessel; and here lies the great source of danger, particularly in steam vessels, as the fires, being at the lowest part of the hull, are soonest affected by the water; and the chances of escape, by being expeditiously run on shore, are thus lost. Indeed, in steam vessels the mere circumstance of derangement to any of those pipes, or connexion between the interior or exterior, for the necessary introduction and expulsion of water from the engine and boiler, have often caused the most serious results. In one instance, the casual introduction of a piece of sea-weed under the valve of the bilge-water pump of a steam-vessel caused it to fill nearly to sinking. But when it is considered that those casualties, which too often occasion the sinking of a steamer, are local in their origin, and affect but a small portion of the vessel, and that the water admitted is often of so small an extent as to be almost within the power of the pumps, it will at once suggest the importance and the efficiency of the protection, by confining the water to that section of the vessel which has sustained the injury.

The plan of dividing the vessel's hull into sections, each of which should be completely water-tight, has, we are told, been practised by the Chinese in their trade barges, the several water-tight compartments being under lock and key, and appropriated to separate shippers.

This mode of giving security first occurred to me on building the iron steamer, the *Garryowen* (now plying on the Shannon, at Limerick), and the trade barges which the Dublin Company's steamers tow on that river. Where the hull was of iron, as in the *Garryowen*, the introduction of iron plate bulkheads was easy and effective; and, independently of the great strength afforded by this internal and sectional bridging, (as it may be called,) these sections were as susceptible of being made water-tight as the vessel itself.

Experience has proved that it is impossible to make a timber partition or bulkhead water-tight, or at least that it should continue so. The heat of the vessel is sufficient to cause such a shrinking in a partition of timber planking, as to render it wholly useless in preventing water from passing. Iron plate partitions, however, possess all the requisites for this effectual division of the vessel into so many water-tight compartments. Their introduction into timber-built ships appeared, then, an important desideratum. Many objections were, however started. Men do not like to be put out of their way; and, indeed, a plan which would prevent ships foundering at sea was, at least, not likely to find much favour in the eyes of shipbuilders.

The only parts where water could pass from any one section, when filled, to another section not so filled, would be, not through the iron partitions, but at the sides and bottom of the vessel, where they came in connexion with the frame and planking of the vessel. The preventing the water from passing in this direction is effected by very simple means, viz., by making this part of the vessel solid, that is, without those rooms or spaces which intervene between the frames of the vessel. This solid framing should extend to 18 inches before and after each partition. The mode of effecting this is familiar to all shipbuilders. The introduction of hairfelt between this solid framing and the planking on the outside, and the ceiling on the inside, completes the operation; the plate iron forming the partition having proper diagonal stays to give it strength, and being connected at the sides and bottom with angle iron, accurately fitted to the shape of the vessel, particularly in passing over the kelsons.

The practicabilty of making these water-tight iron bulkheads being established, the next consideration was the number that would be required and their most eligible position. A *prima facie* view of the case would suggest the greatest possible number of divisions; certainly, the more numerous the partitions are, the more complete would be the protection afforded, and the more the risk of foundering diminished. The only considerations which restricts their number are, 1st, the inconvenience they create by preventing free access from one part of the vessel to the other under deck, the access to each being then, necessarily, from deck. 2ndly, the weight of these iron bulkheads, and the additional timber required to make the vessel solid at the place of junction. 3rd, the expense.

In considering the number and situation of these bulkheads, I will examine the advantages and disadvantages of each.

[Mr. Williams then describes in detail the relative value of one, two, three, or four bulkheads, or partitions, and finally comes to this conclusion :]

We come next to the division of the vessel into five sections, by means of four bulkheads. This arrangement I consider wholly unexceptionable. Besides, this division fell so well in with the business of the several parts of the vessel as to give it at once precedence. The centre section would then be occupied by the engine, boiler and coal-bunkers, thus detaching them entirely from all other parts of the vessel. The sections, Nos. 2 and 4, would be the fore and after

holds, or, in case of passengers' vessels, the fore and after cabins; and the two remaining sections, at the bow and stern, need not be as high as the main-deck, as the water never could rise within several feet of the same.

Here, then, we provide an effectual remedy against the casualties attending on a vessel coming into collision with another. It may safely be said, that unless the water break into the vessel in all its sections at the same time (and which may be considered impossible), there can be no danger of submersion: and experience has proved, that a very small addition of buoyancy would prevent a vessel from sinking after it had been so immersed that the deck was on a level with the surface of the sea. Now, this improvement in the construction of steamers is not brought forward as an ingenious theory, or a matter of unascertained efficiency; I merely submit, for general information, what in practice is adopted by the Dublin Company at this moment in all their lately constructed steam vessels, to give security to the public, and protect their own property from casualty or loss.

The model (furnished with partitions on the plan recommended) is illustrative of what may be seen in several of their vessels now at work: the *Garryowen*, the *City of Limerick*, the *Athlone*, and the *Royal William;* and also in five other vessels recently built by the Company, the *Royal Adelaide*, the *Queen Victoria*, the *Duchess of Kent*, the *Prince*, and the *Princess*. To these he has since added the *Hindostan*, the *Bentinck*, the *Iron Duke*, and the *Lady Burgoyne*.

For testing the efficiency of these bulkheads, and that I might assure the members of the British Association, when in Liverpool, of their having stood the necessary proof, and being practically as efficient as they were satisfactory in theory, I caused the plan to be experimentally tested in the new vessel, the *Royal Adelaide*, for the inspection of the members of the Association. I first caused this vessel to be bored, and the water to flow freely into section 1, at the bow end. When so filled that the water remained at the same level outside and inside the section, it depressed the vessel six inches at the bow, raising the stern about two inches. Having the water pumped out, I then had the next bow section filled (No. 2). This depressed the bow twelve inches, without perceptibly raising the stern end. The vessel was then in the situation of one in which collision had taken place. For accuracy sake, I here state that the bow and stern sections are each 16 feet long; the two next, 35 feet long each; and the centre, or engine section, 58 feet—making in the whole, 160 feet.

The fact of buoyancy, then, not admitting of a doubt, the whole question of efficiency turns on the practicability of making those bulkheads water-tight; this, then, has been tested in so satisfactory a manner that I do not hesitate to affirm that had the *Apollo*, the vessel run into and sunk by the *Monarch* on the Thames; or the Bristol packet, the *Albion*, run on the rocks in Jack's Sound, near Milford, and many other steam vessels, been appointed with those water-tight iron partitions, no risk of life would have occurred, and the vessels would have remained afloat.

With respect to the additional weight and expense of these iron bulkheads, I would observe that, compared with their importance and the security they afford, they are comparatively insignificant. The bulkheads on board the *Royal William* and the *Athlone* cost 290*l*. each vessel, and the additional timber required in the solid framing must be trifling.

Considering, then, how deeply the public are interested in the progress and improvement of steam navigation, and the rapid strides it is making in all parts of the world, and the multiplication of the risks of collision consequent on that increase, it cannot be doubted that it is a legitimate object for the interference of parliament. Can any rational or humane mind contemplate the consequences of a collision between two vessels, and the loss of life that may ensue, and not admit that they who build a vessel hereafter and neglect such precautions, undertake a responsibility of the most awful nature? Had I the power, I would enforce this protection by law. All vessels, especially such as shall hereafter be built expressly for the conveyance of passengers, should have a licence, granted on inspection and before registration, certifying the insertion of those or other equivalent preventives against sinking.

[It is scarcely necessary to add, that had the precaution been taken of having this recommendation of Mr. Williams adopted, the following steam vessels would have been preserved, viz.:—The *Isis*, the *Columbia*, the *Solway*, and the *Memnon*.]

BEALE'S ROTARY ENGINE.

Sir,—In your November Part there is a description of Beale's patent rotary engine, about which (in my ignorance) I wish to ask a few more particulars in addition to the full (?) description given by your correspondent. In the first place, I do not under-

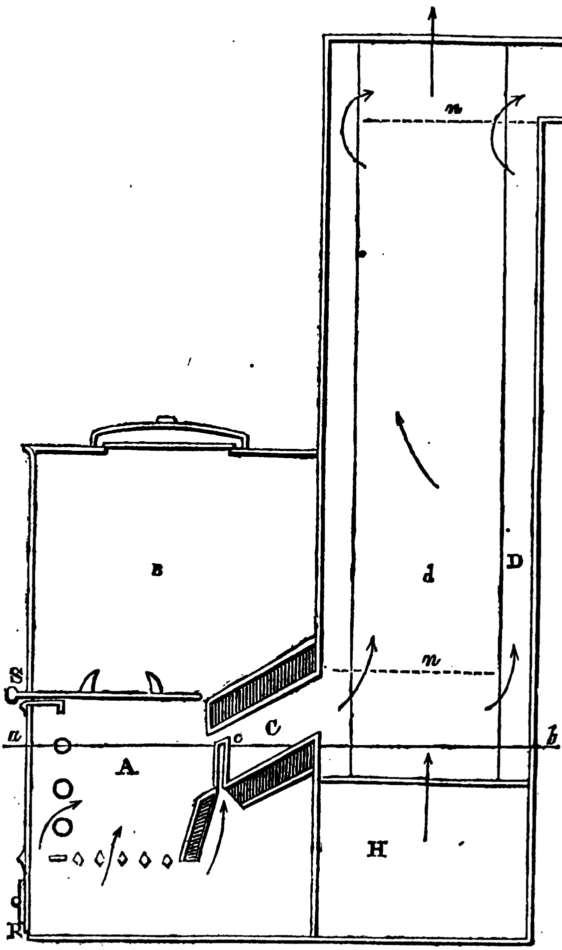
stand how the motion of the engine is entirely a *rolling* one. It is certainly a *rubbing* motion where the rollers move in the grooves. Secondly, as the interior drum, or axle does not touch the sides of the exterior drum at any part, what is to prevent the steam from passing the rollers, and so pressing on both sides, unless they go so (tarnation) quick that the steam *can't* get before them. In the engraving the steam is shown *between* the rollers, as the first roller has not passed the opening to the condenser, and the second roller has just rolled over the steam opening. It may, for what I know at present, be intended that the ends of the rollers, drum, &c. should revolve as close to the exterior drum as is possible without touching, and that the loss of steam past the sides is considered of no account in comparison with the loss that would be sustained by friction. If this is the case, I can see no advantage in the rollers, as a simple vane not touching on three sides would have quite as little friction as the rollers which rub in the grooves. An answer to the above will much oblige,

Your subscriber,

N. E.

ANOTHER STOVE FOR BURNING COALS WITHOUT SMOKE.

Fig. 1.



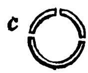
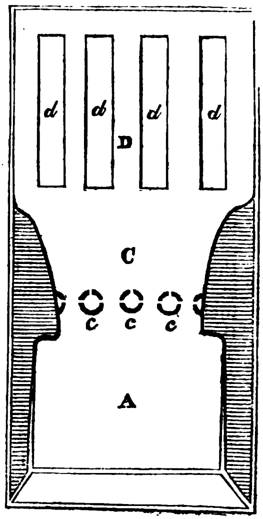


Fig. 2.



Sir,—In continuation of the subject of my communication in your last Number, I offer a second design of a stove for burning coals without smoke, which I think would be found to possess all the requisites of a good stove. The principle is, that of Williams's Argand Furnace,* which, so far as I am aware, has not been applied in the construction of domestic stoves. The successful application of the principle requires a brisk heat to be maintained at the place where air is admitted to ignite the escaping gases; and at the same time, it is necessary to provide that the heat thus given out, be applied to warming the air of a room, without imparting to it a burned quality. These conditions I have endeavoured to meet in the following construction.

Figure 1 is a vertical section through the middle from front to back; and fig. 2 is a horizontal section through the line *a b*, the same letters referring to similar parts in each. A is the grate, with open bars in front; the sides of plates are lined with fire bricks: the lower part of the back is also lined with fire brick: the upper is the opening to the flue C, rising with a small inclination and lined all round with fire bricks to where it communicates with the chamber D. The front frame of the grate is fitted with a close door, having a space of 2 or 3 inches between the front bars and the door, in which latter, glass may be fixed to render the fire visible. The regulator R, for the admission of air, is placed in the front plate of the ash-pan, the air taking the direction of the arrows. Behind the back of the grate, in the opening C, are placed air tubes *c c c*, for supplying air to ignite the heated gases, as they pass from the grate; and they also serve the purpose of supporting the fuel in the grate, and preventing it spreading up into C. These air tubes rise more than half way across the opening, and have three longitudinal slits or openings through the whole length of their exposed parts, the better to assist the diffusion of the air: these slits are more clearly seen in the cross section of one of the tubes represented separately on an enlarged scale. B is a magazine or coal-box, to contain a supply of coals for an assigned period, and is open below to the fire, and closed air-tight at top by two covers. An open frame with spikes upon it, is placed at the mouth of the coal-box, and is capable of sliding forward and backward, by pulling and pushing the handle S, by which the descent of the coals into the fire is facilitated and raking prevented. The magazine may be supplied with coals from a box with a sliding bottom, adapted to the aperture of the magazine, corresponding with which the inner cover of the latter should also have a sliding or lateral movement, and both being drawn aside at the same time, the coals descend from the box to the magazine, and the cover of the latter is then replaced and the box removed. This apparatus, which is Mr. Prosser's invention, is described along with his "Vesta" stove in your No. 909, January 9, 1841. The same object, however, might be effected by a sliding plate placed across the mouth or lower opening of the magazine, which could then be supplied with coals in the ordinary way. D is an oblong rectangular chamber of the same breadth as the stove, but rising considerably higher, and communicating at the bottom with C, and at top with the flue F. A series of air-tubes, of thin metal, *d d d*, similar to those of Jeffery's pneumatic grate, pass through this chamber, communicating at top with the air of the room, and below with the air-box, or chamber H, which may be supplied with air either from the apartment itself, or through a pipe conveyed outside the house, and communicating with the external atmosphere. The direction of the air through the air-tubes is indicated by the straight arrows. Across the lower part of the chamber D, and on a line with the upper part of C is placed a perforated plate, or a diaphragm *n*, extending as far back as the posterior ends of the air-tubes; and a similar plate, *n*, is placed near the top, on a line with the under side of the flue F, and extending as far forward as the anterior ends of the air-tubes. The object of these plates is to cause a partial obstruction to the current of heated gases, so as to make them take a direction, first towards the back of the chamber D, and then again towards the front before passing into the flue, as indicated by the curved arrows; and thus circulate equally through every part

* In thus avowedly stating, that this and the former design are based on principles protected by patent rights, I desire to guard against being supposed for a moment to wish a surreptitious use to be made of inventions so protected; my only object being to suggest particular applications of their principles, which I hope may be of utility, leaving those, who desire to give them effect, to take the proper means for doing so.

the chamber, and between the air-tubes, instead of passing in a straight diagonal course from C to F.

This stove is not properly of the slow burning kind; but being under regulation, I consider that the consumption of coals would be much less than in an open grate, independently of its superior economy in these respects, viz.: 1st, That in consequence of the more perfect combustion of the fuel, there would be no loss of combustible material in the form of smoke, and therefore, a greater amount of heat would be given out from the same quantity of coals. And 2nd, That the heat given out, instead of being dissipated up the chimney, as in an open fire, is mostly turned to use in warming the air of the room, through the medium of the chamber D and the air tubes. The *unapplied* heat, passing off at the flue F, may be reduced to the lowest degree, consistent with maintaining a sufficient draught, by enlarging the chamber and increasing the number, size, or length of the air-tubes. Its economical advantages, moreover, are not obtained at the expense of proper ventilation, or a due supply of respirable air; nor accompanied, as in some hot-air stoves, by the deterioration of the air from passing in contact with highly-heated metal plates, the air tubes never becoming heated to a degree that can be injurious to the wholesomeness of the air.

I am, Sir, &c.

N. N. L.

December, 1843.

ANTIQUITY OF CAST-IRON.

Sir,—A short time ago a discussion took place respecting the antiquity of cast-iron: one party maintained that the art of casting iron was not known to the Romans, or to any European nation prior to the fifteenth century; and that no other than malleable iron was known, produced by heating the ore, and reducing it to pure metal by hammering:—whilst the other party said, that as the ancients understood the method of casting silver, gold, and copper, there could be no reason to doubt their possessing the art of casting iron also:—and as neither party was convinced of the arguments adduced by the other, it was agreed to refer the question to the *Mechanics' Magazine*; and, in consequence, I take the liberty of troubling you upon the subject, hoping you will inform us whether the art of casting iron into moulds was known to the Romans, and how long it has been in practice?

I remain, &c., &c.,

ONE OF THE PARTIES CONCERNED.

[There is no positive evidence, we believe, extant, that the casting of iron was known to the Romans; but there are passages in the Greek writer, Pausanias, which prove, beyond all doubt, that the art was practised, and, indeed, carried to a very high state of perfection among the Greeks; from whom one would think it could hardly fail to descend to the Romans, who were their immediate successors in the occupation of the greater part of the south of Italy. Pausanias ascribes the invention of "the art of *casting iron*, and *making statues of it*, to Theodorus, the Samian;" and in another place he has the following passage:—"At Delphi is dedicated a Hercules and hydra, *both of iron*. To make statues of iron is most difficult and laborious; but this work of Tisagoras, whoever he was, is really admirable. In Pergamus are the heads of a lion and of a boar, *both of iron*." But whether the art came down to the Romans, or not, it is certain that all traces of it had disappeared from Europe when it began to emerge from the barbarism of the Dark Ages. In the well-known work of Agricola, *De Re Metallica*, 1550, there is mention made of *cast-iron*, as an ingredient made use of in the manufacture of malleable iron; but he nowhere speaks of it as being applied to foundry purposes in the same way as in modern times. The date of the revival of the art can hardly be fixed earlier than the sixteenth century; and the honour of that revival belongs indisputably to our own countrymen, Sturtevant, Dudley, and Owen.—ED. *M. M.*]

WEALE'S QUARTERLY PAPERS ON ENGINEERING. PART II. CHRISTMAS, 1843. VOL. I. COMPLETE.

Whatever doubts of the success of this undertaking may have been entertained on the appearance of the first Part—which, like almost all first parts and first numbers, was of something less than *first*-rate quality,—these doubts must be completely removed by the contents of the second Part now before us, which completes Volume the First. The papers in this part are all of a very practical and most useful character, well-written, and illustrated (where necessary) by engravings, from master-hands, and on a scale of magnitude which bears honourable

testimony to the spirit and liberality of the enterprising publisher.

Article I. is on "Setting out the Widths of Ground required for the Works of a Railway or Canal; depending on the depth of cutting or height of embankment, and the transverse slope of the natural surface," by Frederick Walter Simms, C.E.

Article II. is a "Memoir of William Jessop," by Samuel Hughes, C.E., to which is prefixed a very fine portrait of that distinguished ornament of his profession. From this Memoir we extract the following interesting particulars:—

"The father of Mr. Jessop was engaged under Smeaton in superintending the erection of Edystone Lighthouse, and William Jessop, the subject of this memoir, was born at Plymouth in the year 1745. When young Jessop had attained the age of sixteen, his father died, leaving the guardianship of his family to Smeaton, who thenceforth adopted William as his pupil, and determined to bring him up to his own profession. With Smeaton he continued for ten years, and very great must have been his opportunities of acquiring knowledge during this the busiest part of Smeaton's active career.

"It is not generally known that in 1791, a year before his death, Smeaton formally retired from the profession, issuing at the same time a circular to inform his friends of his desire to dedicate the remaining years of his life to a description of the works executed under his direction.*

"After leaving the service of Smeaton, Mr. Jessop was engaged for several years in improving the navigation of the rivers Aire and Calder and of the Calder and Hebble, in Yorkshire. He was also employed on the river Trent, in Nottinghamshire, and these works appear to have afforded his principal occupation for some time after he left Smeaton. A few years before the retirement of the latter, his pupil seems to have been getting into active employment, as we find him about the years 1788 and 1789 reporting on the navigation of the Sussex Ouse and the drainage of Laughton Level in the same county, while at this time he had also the honour of being called on by the Commissioners of the Thames and Isis, to advise on the works they had undertaken and were about to execute for the improvement of this important navigation.

"In the three following years, 1790-2, his professional employment appears to have greatly increased. He was now actively engaged in prosecuting various important canals in connexion with the great central navigation of the Trent. Amongst these are the Cromford Canal, penetrating amongst the mountains of Derbyshire into the rich mineral districts of that wild, romantic country; the Nottingham Canal, which connects the Cromford with the Trent at Nottingham; the Loughborough and Leicester navigation, connecting the Ashby coal-field with the navigable part of the Soar and with Nottingham, thus opening an important communication with the Trent on the one hand, and with Nottingham and the whole south of England on the other. Besides this system in connexion with the Trent, he projected and commenced at this period the Horncastle navigation, which, besides acting as a valuable drainage for this part of the fens, was productive of great benefit to a large district, which it brought into communication with the river Witham, which latter is navigable to the sea in one direction, and in the other through Lincoln to the Trent. But a larger and more important work than all these was the Grand Junction Canal, which connects the whole inland navigation of the country with the metropolis, by means of a line traced in a diagonal direction across the two formidable ranges of hills peculiar to the secondary formations of England.

"The year 1793 also originated several great projects, amongst which were the Grantham Canal, supplied by vast artificial reservoirs, and extending from the river Trent, through a rich pasture district of the new red sandstone, and winding for many miles through the broad and fertile vale of Belvoir up to Grantham, at the base of the Lincolnshire hills, the furthest point to which it is possible to penetrate in this direction. The Barnsley Canal, which opens up an immense amount of mineral wealth in

* As this circular is probably in the possession of very few persons at the present day, and as it may amuse some of our readers, a copy of it is here inserted *verbatim*:—

"Mr. Smeaton begs leave to inform his Friends and the Public in general, that having applied himself for a great Number of Years to the business of a *Civil Engineer*, his wishes are now, to dedicate the chief part of his remaining Time to the Description of the several Works performed under his Direction. The Account he lately published of the Building of *Edystone Lighthouse* of Stone, has been so favourably received, that he is persuaded, he cannot be of more Service to the Public, or show a greater Sense of his gratitude, than by continuing to employ himself in the way now specified. He therefore flatters himself, that in not yielding to the many applications made to him lately for further Undertakings, but confining himself in future to the Objects above-mentioned and to such occasional Consultations as will not take up much Time, he shall not incur the Disapprobation of his Friends.

"Gray's Inn, 6th October, 1791."

the Yorkshire coal-field, and brings it into communication with the river Calder and the Dearn and Dove Canal; and lastly, the great Ellesmere Canal, which completes a communication between the Severn and the Mersey, and ramifies in numerous directions amongst the rugged hills and romantic valleys of North Wales. Such were a few of the great works which Mr. Jessop was engaged in preparing up to the year 1793, before which time also he had been called into Ireland, and was taking an active part in carrying on the public works which had been undertaken under the authority of Parliament in that country.

"The execution and management of the numerous works which have here been glanced at must have occupied most of Mr. Jessop's time during the next few years; but the dawn of the following century was the signal for another torrent of speculation which, in addition to canals, began now to be directed towards docks and railroads. The promoters of the first great public dock establishment in the metropolis called upon Mr. Jessop to conduct their works, and he had the honour of completing the great project of the West India Docks, with their numerous accompanying details, in a manner which would alone entitle him to rank among the greatest engineers which this or any other country has ever produced. Scarcely were these great docks completed, when Mr. Jessop was required by the citizens of Bristol to effect a great and comprehensive measure of harbour improvement, designed to place the port of Bristol at once in the foremost position with respect to commercial advantages. In all the various and complicated works connected with the great dock establishments of London and Bristol, Mr. Jessop's labours were distinguished by consummate ability and a judgment which was rarely known to fail, although tried by the severe test of many novel and unprecedented practical experiments. He was now also astonishing the mechanical world by the effects produced on the railroads he had constructed in connexion with his canals in the mining districts of Derbyshire, Yorkshire, and Nottinghamshire, and busily engaged in tracing the first public railroads constructed in the neighbourhood of London. These are the well-known tram-roads connecting the fullers'-earth pits and firestone quarries of Nutfield and Merstham with the Croydon Canal and the river Thames at Wandsworth. The last great work that remains to be noticed is the Caledonian Canal, which he was specially called upon to survey before its commencement, and of which he continued to be the consulting engineer for many years."

Mr. Jessop died in 1814.

Article III. is "On the Utility and Construction of the Dredging Machine." The writer first gives a detailed statement of the principal places where dredging has been, and is now, carried on; and then descriptions of two of the most recently constructed machines for this purpose—one by Messrs. Summers, Graves, and Day, of Southampton, and the other by Messrs. Girdwood and Co., of Glasgow. The article is accompanied by eight large plates.

Article IV. is "On the Advantages of employing a Framework of Malleable Iron in the construction of Jetties and Breakwaters." By James Vetch, Captain Royal Engineers, F.R.S. Captain Vetch advocates the theory, first propounded (we believe) by Lieut. Colonel H. Jones, R.E. (see vol. xxxvii. p. 214), that piers and breakwaters having long slopes towards the sea are the most liable to destruction, while those approaching the perpendicular are the least so. And on this basis he builds the plan described in the paper, of which a sufficiently clear idea may be formed from the following brief extract:—

"The mode of construction upon this project consists essentially in the application of upright rods of malleable iron, steadied and fixed in their places by passing them through apertures in two parallel and horizontal frames of flat iron, provided with corresponding orifices to receive them; the lower frames being placed about three feet above the low-water mark, and the upper frame about three feet above the high-water mark, or at such other convenient distances apart as the circumstances of the case may demand. The horizontal frames may be conveniently constructed in short lengths, say of four feet each, and an additional piece of frame may be connected with the preceding one by round bolts passing through loops, forming so many moveable joints, that the frames may be the more easily raised, lowered, or adjusted to the required level, if from the settlement of the upright rods they have swerved from their original horizontal position. The new lengths of frames having been bolted to the preceding ones, and retained in a horizontal position by diagonal stays, are ready to receive the upright rods, which are then to be dropped separately through the corresponding apertures of the frames, and each allowed to

take its bearing separately by its own gravity, or by such farther pressure as may be deemed proper. When the rods have taken their bearing and settlement, a row of sloping rods have to be added to each side of the jetty, inclining inwards one foot in ten or twelve, to give lateral support; and at this state of the operation, it is proposed to key on to the rods the iron collars for the permanent support of the horizontal frames and the platform."

Captain Vetch estimates that the expense per lineal yard of a breakwater of this description would be 148*l.* 13*s.* 8*d.*, while the Plymouth breakwater cost about 1000*l.* per lineal yard, and the harbours of refuge, which it is in contemplation to erect on the coast of Kent, have been estimated to cost 660*l.* There would also be an immense saving in time:—

"The Plymouth breakwater took twenty-eight years to complete, and it is understood, fourteen years has been estimated as the required time for the harbour of refuge at Dover; now, in the construction by iron framing, it is reasonable to assume that a frame of four feet may be set each tide, and by working from two ends, sixteen feet per diem ought to be performed in good weather; the length of sea face of the proposed harbours of refuge average 9100 feet, so that 569 days would be required to complete the iron framing for one, and allowing for Sundays and bad weather, the work would be accomplished in less than three years, say in one-fifth of the time estimated for the Dover harbour, on the principle of construction of the breakwater in Plymouth Sound."

THE PENNY CYCLOPÆDIA. VOL. XXVII. WAL—ZYG.

We have now before us the finishing volume of this *magnus opus* of the Useful Knowledge Society. We thought that it had been admitted on all hands—some considerable merits notwithstanding—to be a failure; but if the Committee of the Society, with Lord Brougham at its head, are to be believed, it leaves, on the contrary, little, if anything, to be desired! In a valedictory address from the Committee, which is prefixed to this last volume, it is described as a Cyclopædia "without any *important* omissions"—a work which "may fairly take rank amongst works of authority, *systematically* conducted, without any improper abridgment of labour or expense;" and this "although it is the cheapest original work of the class which any country has produced." The publisher of the Cyclopædia takes a flight still higher than his masters of the Committee, for he protests in a separate address of his own, that "the articles in *many* of the great branches of knowledge are regarded as authorities, and have acquired celebrity wherever the English language is read!" Only two slight specks in this brilliant picture are confessed to; one by the Committee, who say that "the limits proposed for this work have been exceeded by about one-fourth," and the other by Mr. Knight, who says that "the name of the Penny Cyclopædia was derived from its original issue in a weekly sheet, when a work of much less magnitude was contemplated;" but that the word "PENNY is now (to be) received as indicative only of its extreme cheapness."

We took no small pains at the commencement of this work to point out wherein it was deficient, and how it might be improved; and we shall not now shrink, at its conclusion, from stating openly what we think of these boastful pretensions. Verily, then, we think them a perfect disgrace to the parties from whom they emanate. The "limits exceeded by about one-fourth" only! As audacious a misstatement as ever was uttered or published. The "limits proposed for this work," as any person may satisfy himself by referring to the original Prospectus, were *eight* volumes. The actual number is *twenty-seven*. An increase of *nineteen* instead of *two!* "*Systematically* conducted, without any improper abridgment of labour or expense." Yes, truly, if *system* it be, to have had no system at all—if acting *systematically* it be, to have gone to work without any thought whatever as to the comparative importance and value of articles—if "improper abridgment of labour" there be none in allowing one man to expatiate *ad libitum* on the mere husks of knowledge, and limiting another to the smallest possible space for the

examination of the kernels within—if "improper abridgment of expense" there be none in lavishing money on garbage, and leaving nothing to pay for many of the most valuable products of the garden and field: yes, if *system* it be to allow to the first three letters of the alphabet three times the space allowed to any of the others—if *system* it be to begin with dividing a discourse into *eight* heads, and end with *twenty-seventh and lastly*. "Without any important omissions!" We should like to have but a silver groat for every "important omission" we could point out. To confine ourselves to the volume before us, there is not in the article "Weights and Measures," (in all other respects a very good treatise on the subject,) nor anywhere else in the Cyclopædia, any account of the new mode of measuring the tonnage of vessels, though manifestly a matter of the first importance, and established by an Act of Parliament, which is not of yesterday, but some five or six years old. Nor in that on "Woollen and Worsted Manufactures," and the "Processes" comprehended under it,—a word of the modern processes of Drying by Centrifugal Action, and Felting instead of Weaving. It has been so all through: scarcely an article can be mentioned which has not been quite as remarkable for what it did not contain, as for what it contained. Mr. Knight is pleased to say, that "the articles on *many* of the great branches of knowledge are regarded as authorities, and have acquired celebrity wherever the English language is read." Will Mr. Knight be so good as to specify what these "many articles" are? For ourselves, we must confess that we are in a state of absolute ignorance on the subject. But, then, there is the cheapness! Other Cyclopædias have been cheap; but this, according to both Committee and Publisher, is the cheapest of all! Cheapness is a term which must be guaged by the test of merit. To call an Encyclopædia a "Penny" one, is no more "indicative of extreme cheapness" than it would be to call it a "Sixpenny" or a "Shilling" one. As there is such a thing as being "*penny* wise and *pounds* foolish," so is there such another thing as paying "too dear for the (penny) whistle." An article may be dear at a penny, which, if made of a better quality, would be cheap at a shilling. Now, what is it we ought to look for in a Cyclopædia? Is it not something on every thing—either full information on all matters of importance within the circle of human knowledge, or abbreviated notices, with references to the sources, where deeper draughts of instruction may be obtained? Tested by this standard, the *Penny Cyclopædia* is anything but a cheap work. We know of no work of the kind which, if consulted as a book of reference, is more likely to disappoint a reader. The information given is often exceedingly incomplete; rarely of the newest; now and then very erroneous; and, not seldom, amounts to just nothing at all. Surely something greatly better than this might have been expected for Ten Pounds—the sum which the *Penny Cyclopædia* now costs in its complete state. Ten Pounds is no trifle, especially to persons of the middling and lower classes, for whose special benefit this work was stated to have been designed; nor would it be difficult to point out many ways in which such a sum might be laid out in the mart of literature to much greater advantage than in the purchase of *penny-worths* like this.

All that we have said of this Cyclopædia generally, is quite consistent with a cordial recognition of great merit in particular portions of it. The astronomical and mathematical, chemical and geographical departments, are by far the best executed; the mechanical and manufacturing (of which we are perhaps most competent to speak) among the worst. All that Airy, and De Morgan, and Phillips, and a few others of the same high stamp, could do to give reputation to the work has been done; but the shellfish-mongers, the grub-catchers, the geologists, the philologists, and the Scotch lawyers, have been too many for them.

We give from the concluding volume before us a couple of specimens of the better sort. The first is from an article on the "Zenith Sector:"—

"When Troughton first proposed the mural circle as the best form for a meridian declination instrument, great doubt was thrown on the practicability of observing by reflection with sufficient nicety; and, in that case, as the mural circle does not reverse, a supplementary instrument was wanted to show the position of a zenith or horizon. Partly on this account, but chiefly to settle the constants of aberration and precession with the greatest precision, Troughton planned a *zenith tube*, consisting of a telescope of 25 feet focal length, without any sector, and in which the variations of zenith distance of γ, Draconis, and close zenithal stars, were to be measured by a micrometer screw. The instrument has not been described; indeed it can scarcely be considered as yet completed, though several improvements have been made in its construction by Mr. Airy, since his appointment as Astronomer Royal. The telescope rests on its lower end, continued beyond the focus, on a piece which has adjustment for verticality, and a collar below the object-glass is pressed by a spring into a Y bearing. The wires at the focus are moved by a micrometer screw, and the star and wires are seen through a diagonal four-glass eye-piece. The plumb-line hangs within the tube, and is viewed above and below by micrometer microscopes. Instead of adjusting the plumb-line before each observation, it is bisected by the micrometers after the observation, and a correction applied, which is deduced from the upper and lower readings. Mr. Airy having had some reason to suspect that the wire twisted on reversing the instrument, has given a double suspension to the plumb-line, and made the instrument reversible on a star in the same night, by using a stop, as in the ordnance sector. The observations with the zenith-tube are printed yearly in the Greenwich Observations.

"The zenith sector has not been much used upon the Continent since the great surveys made in the middle of the last century for ascertaining the figure of the earth. In the French arc from Dunkirk to Formentera, the latitudes were observed by the repeating circle; and in some of the stations there is reason to suspect that error has been committed. More recently, the transit in the prime vertical has been employed in Germany and Russia, for ascertaining differences of latitude, and, as it would seem, with great success. A prime vertical transit has lately been constructed by Repsold, for the imperial observatory of Pultowa, of which a most favourable account has been given by Professor Struve. While admitting the excellence of this kind of instrument for telescopes of moderate size, we do not see how they can equal, far less surpass, the zenith sector, when made reversible, and of the proper magnitude."

The next extract consists of a brief but interesting notice of the inventor of marmotinto—a curious art, which was in great vogue in the days of our grandfathers, but has long since gone entirely out of use:—

"Zobel, Benjamin, the inventor of marmotinto, was born in 1762, at Memmingen in Bavaria. He received his education at the government school of that city, and acquired the rudiments of drawing from one of the monks belonging to the convent of Ottobenern. In 1781, he went to Amsterdam, where he resided for two years occupying himself chiefly in portrait-painting. In 1783, he came to London, where he formed acquaintance with Morland and Schweickhardt, the latter of whom was employed at Windsor Castle, by George III's "table decker." It was then the custom to ornament the royal dinner table by having a silver plateau extending along the centre, on which were strewed various coloured sands or marble dust; in fanciful designs of fruit, flowers, arabesque work, &c. For this an artist of considerable talent and of great freedom of hand was required. On the retirement of Schweickhardt, Zobel was appointed; and he continued to fill the office for a considerable period. Ornamenting the royal table in the manner just described was a daily occupation, the sands not being cemented by any substance. From this occupation arose the idea in the mind of Zobel of producing a finished and permanent picture, by the use of some substance by which the sands might be fixed. After various experiments, a composition (in which gum-arabic and spirits of wine formed the chief ingredients) was found to answer the best. The subject of the picture having been designed either in panel or milled board, a coating of the glutinous substance was spread over it; the different coloured sands were then used in a similar manner as that employed in decking the royal table, viz. by strewing them from a piece of card held at various elevations, according to the strength or softness of the tint required. Thus was formed a picture, not subject to decay, and perfectly permanent in all its parts, and this was called by the inventor Marmotinto. Some of the best specimens of this peculiar art were formerly in the possession of the late Duke of York, but were sold, at his death, at Oatlands. Several are still among the collections of paintings belonging to the Duke of Northumberland, and Sir Willoughby Gordon.

"Painting on gold and silver grounds in transparent colours for the representation of cabinets of humming-birds, &c., was also practised with eminent success by Zobel. He died in 1831."

MR. PEACOCK AND THE PELL PROBLEM.

Sir,—My not receiving your valuable Journal, except in monthly parts, has prevented me from replying to Mr. Peacock sooner. I am perfectly satisfied with his explanation, since he also appears to be satisfied that the honour of the *discovery* belongs to another party; and the object of my note is fully attained, seeing that Mr. Peacock has relinquished all *claim*, except to *similarity* of solution.

I intended to say a few words on the comparison of the relative *magnitudes* of *mind*, contained in the opening sentence of the reply, but a reference to pp. 197-8 of your xxvth vol., where Mr. Peacock is discussing circulating decimals with a "Country Teacher," will render this unnecessary: any of your *judicious* readers, who will take the trouble to refer to that controversy, will be at no loss to come to a correct conclusion as to what *magnitude* either *one* or *both* of us must necessarily belong.

Yours very respectfully,

THOMAS T. WILKINSON.

January 4, 1844.

NOTES AND NOTICES.

The Patent Kindle Engine.—We had the pleasure, lately, of examining one of those ingenious implements, lately constructed and patented, for the purpose of producing instantaneous light. It consists of a glass vessel, the diameter of a large tumbler, and about twice as high, covered with a well fitting brass lid; from this lid an inverted glass tube is suspended to act as a gasometer, and within it is suspended a piece of zink. In putting it into a working state, a mixture of vitriol and water is poured into the outer vessel, and this coming into contact with the zink, evolves hydrogen gas, which is collected in the glass gasometer always ready for use. On the brass lid, a tiny lamp is affixed, and a small chamber, in which is placed a piece of platina wire. In striking a light, all that is necessary, is to press down a spring like the key of a flute; this at once opens a valve to let the hydrogen play on the platina, and makes the lamp to place itself in a line with the flame produced. After being lighted, it moves out of the way, and the valve closes in readiness for a succeeding operation. The article is very neat withal, and serves for a mantelpiece ornament, as well as for the purposes for which it has been constructed—*Paisley Advertiser.*

A plough to dig Potatoes attracted much attention at the fair of the American Institute in New York. It is the invention of a young man of Schenectady, and is represented to be capable of digging in a complete and clean manner six acres per day, or say 1,500 or 2000 bushels, with the same ease a single hand with the hoe will dig fifty bushels per day. The importance of this machine may be known, when it is recollected, that the potato crop is of more value than the wheat crop in the United States.—*New York Evening Post.*

The Mud Nuisance.—Our attention has lately been called to a proposal to prevent much of the mud which disfigures our streets, and also much of the inconvenience arising from the frequent repairs now necessary to the paving. It is by adopting a system of under-drainage, which really appears deserving of notice. On each side of the street and underneath the paving (whether of wood or stone) are to be laid a row of drain pipes, which empty themselves into the sewers of the water they collect or receive, on the same plan that drain-tiles are used in wet lands. These pipes are very ingeniously formed, with numerous apertures, and which, as they enlarge inwards, will not choke. They also admit of being easily opened at any part and inspected. The patentee asserts that a street may be thus drained for an expense not exceeding 7½ per cent. on the cost of wood-paving, and that the great cause of mud is from the foundation when wet working up between the blocks of which the pavement is composed. It appears reasonable and probable that this should be the case, from the lower part of a street looking worse than the higher part; and until the rain water, which so copiously falls in our climate, is afforded a channel for running off, it continues to destroy the foundation, and if that is removed, the paving of course sinks in such places. We do not know that it has yet been tried upon any street in London, but are told that several eminent engineers are using the patent drain-pipes in railway works.—*Standard.*

New Method of ascertaining the Specific Gravity of Fluids.—At the meeting of the Literary and Philosophical Society of Liverpool, Dr. Jeffreys called the attention of the society to a new mode, proposed by Sir James Murray, at the Surgical Society of Ireland, of ascertaining the specific gravity of fluids. Sir James considered the common methods tedious and uncertain, owing to the inaccuracy of the balances generally used; he, therefore, proposed to let the atmosphere take the place of scales and weights, and exhibited a model of an apparatus, which consisted of two glass tubes, open at the bottom, and connected at the top by a shorter semicircular tube, or by a globe, so as to make the entire as it were one tube. The cross tube, or globe, was to have a stop-cock connected with it, by means of which, when the lower extremities of the tubes were inserted in two liquids, a portion of the air was to be extracted from the upper part of the tubes. In proportion as the air was rarefied, the liquids rose in the tubes, and the height to which they rose was always in an equivalent to the specific gravity of each.

Effects of Lead Pipes upon Water.—Professor Hare, speaking of the influence of lead pipes upon water, says:—"Respecting the influence of lead pipes upon the water which they convey, it may be sufficient to say, that having used the Schuylkill water, so conveyed to my laboratory, in the university, for more than twenty-five years, I have never perceived the slightest indication of the presence of that metal. Had there been any lead in the liquid in question, the re-agents with which I have been accustomed to use it, must have rendered the impurity evident."

Erratum.—Last vol., page 403, line 51. For "4015320," read "4019854."

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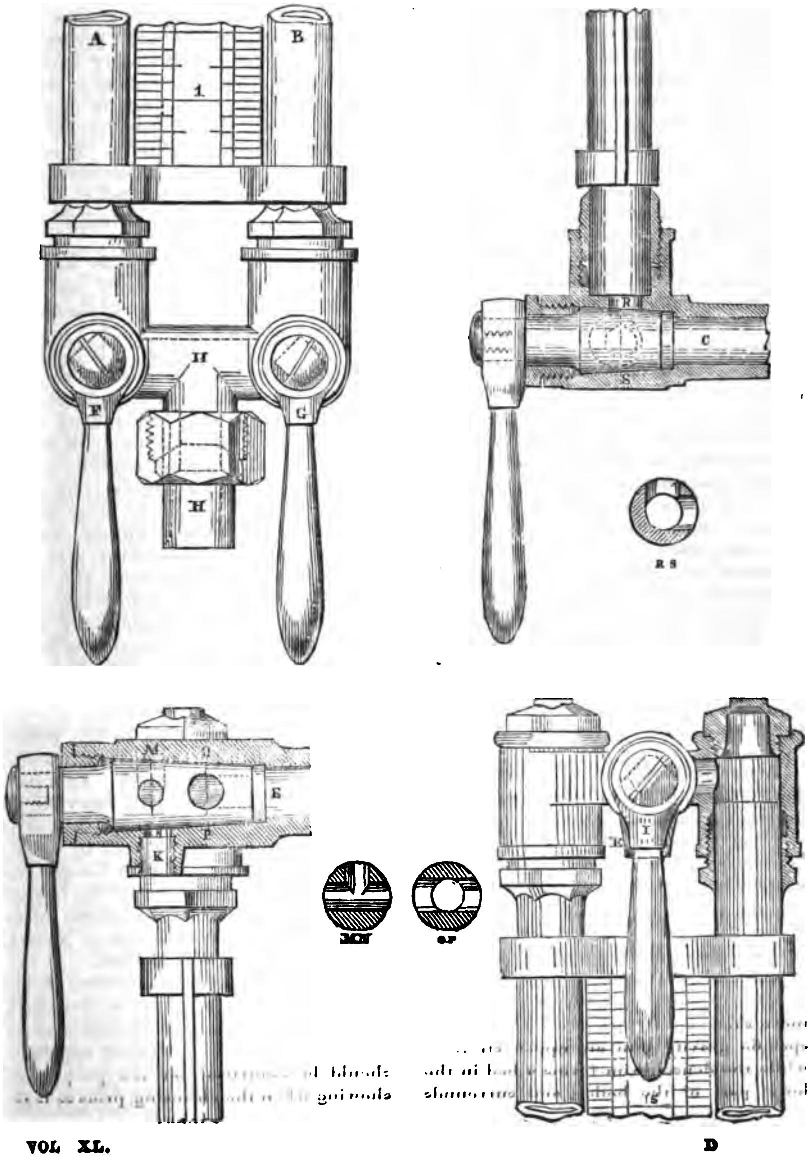
MR. J. SCOTT RUSSELL'S MARINE SALINOMETER.



MR. J. SCOTT RUSSELL'S MARINE SALINOMETER.

[From Description by Mr. Russell read before the Royal Scottish Society of Arts, and published in the last Part of their Transactions. The Society afterwards awarded their Honorary Silver Medal to Mr. Russell for his communication.]

Very early in the history of steam navigation, the inconvenience of raising steam from salt water was experienced. When the *Comet* descended below Port Glasgow in 1812, the boiler was found to boil over, or prime, as it is technically called by engineers, when part of the water is forced up so violently, along with the steam, as to pass over into the cylinder of the engine—a circumstance always detrimental, and sometimes destructive to the engines. This arises from the thickening of the water, its density being increased by the retention of the solid substances which compose sea-water, and which remain and accumulate in the boiler, while the fresh portion of the water is passing off in the shape of steam.

This process of accumulation of solid matter in the marine boiler is by no means slow. The whole of the water which a marine boiler usually contains is evaporated in three or four hours, leaving the solid substances in the cubic content of boiler behind it, and being replaced by salt water, with an equal quantity of depositary matter, accumulating as rapidly as before; and since it is known the solid matter amounts to as much as $\frac{1}{40}$ of the whole mass of water, it would follow, if the process of ebullition could continue so long as 150 hours, there would be deposited in the boiler a quantity of solid matter equal to the number of tons of water in the whole content of the boiler.

Long, however, before this degree of solidification can take place, evils of a different description intervene to impair and put an end to the functions of the boiler. The solid constituents of salt water which are left behind do not diffuse themselves uniformly over the whole liquid mass, so as to constitute a homogeneous brine; on the contrary, the new supplies of sea-water, as they enter the boiler, remain secluded from the former more saturated brine, rise by their less specific gravity into an upper stratum, while the denser brine forms a bed in the lower part of the boiler, and surrounds the fire-box and heater-flues occupying the water-spaces and legs, which are usually at a high temperature, and which, in double-tiered boilers, are generally the most intensely heated. The intense heat of the metal expels the water from the brine in contact with it most rapidly in the hottest places, and salt is deposited on the hottest parts of the furnaces and flues, extending rapidly to those less heated, and so not only diminishing the evaporative power of the boiler, but injuring its substance, and endangering its existence.

The remedy for these evils was very early invented. But I have not been able to discover the inventor of the cleansing process commonly called "blowing down," or "blowing off." It is almost universal, and is performed in the following way: There is forced into the boiler, at each stroke, rather more water than is required for the supply of steam, so that the boiler becomes too full. Openings are then suddenly made at the bottom of the boiler, and the brine at the bottom being violently ejected, carries with it any solid substances that may have accumulated near the bottom—the boiler is thus cleansed; and before the water has got too low, the openings are again closed, and the boiler continues to be fed as formerly.

Another remedy, pretty generally adopted, is the brine-pump, by which, for every portion of water supplied to the boiler, about one-fourth part of that quantity of brine is withdrawn from it. This process does not so thoroughly carry off all the impurities as the former; but it is attended with a saving of fuel by a contrivance for giving to the feed-water entering the boiler a portion of the heat of the discharged brine. The recent introduction of this process is due to Messrs. Maudslay and Field of London.

In whatever way the saturation of the water with solid matter may be remedied, it is essential to the accomplishment of this object, that some simple apparatus should be contrived for the purpose of showing when the cleansing process is re-

quired, and whether it is successfully applied. If this be not obtained, the usual consequence of acting on wrong data are sure to follow.

A contrivance was patented, which was thought promising, but was found liable to be mechanically out of order when most wanted; a ball of greater specific gravity than salt water was connected with an external index, by which there was indicated on the outside the fact of the brine becoming sufficiently saturated to float this ball.

Another was to place in the glass gauge of the boiler a glass hydrometer bead, which would float when the brine became saturated to a given point, and fall to the bottom in the ordinary state of the boiler. But this fails entirely of accuracy, although very elegant; for the brine of which we wish to indicate the density is in the lower stratum, not the upper one, where the usual glass gauge is placed, and irretrievable mischief might be done before the indicator would show any change.

I have lately employed, in some large ships destined for transatlantic voyages, a species of brine gauge, or index of saturation, which is found to possess every advantage, and which I therefore desire to communicate to the public through this Society. The accompanying figures are such as may enable any engineer to construct them for himself. The details of the arrangement of the apparatus were made under the direction of Mr. James Laurie, formerly one of my assistants; and he also has obliged me by writing out the annexed description of the operation of using the index.

The principle I have used is the well-known law "that the heights of equiponderent columns of liquids vary inversely as the densities of those liquids."

If I take open glass tubes bent in the form of the letter U, and pour one fluid into one of the sides, and another fluid into the opposite side (taking care to use the heavier liquid *before* the other): the one being mercury, and the other water, they will stand at the height of 1 inch and 13 inches respectively. If I use alcohol and water they will stand at the height of 10 inches and 8 inches respectively, the height of the one fluid being always greater than that of the other, in the proportion in which its weight, density, or specific gravity is less.

In like manner, fresh water and salt water will stand at heights of 40 and 41 inches, showing a difference of 1 inch.

The use which I make of this principle is as follows:—I reckon the best scale of saltness of a boiler to be that which takes the common sea-water as a standard. Sea-water contains $\frac{1}{40}$ of saline matter. When the water has been evaporated, so as to leave only half the quantity of distilled water to the same quantity of saline matter, I call that two degrees of salt, or brine of the strength of two, and such brine would show the columns 40 and 42, or double the saltness of sea-water, indicated by a difference of 2 inches. A farther saturation would be indicated by a difference of 3, 4, 5, and 6 inches beween the columns, and so indicate 3, 4, 5, 6, and any farther degrees of saltness—a range which may be made to any degree of minuteness by the subdivision of the scale of inches. This scale is that which appears to me most simply applicable here—and it is that which I adopt for marine boilers.

The mechanical apparatus which I have employed to give this indication is perfectly simple, and has the advantage of being such as the engineer already perfectly understands. To the marine boiler I apply two water-gauges of glass, instead of one as at present used; they both serve the purpose of the present glass gauges, and the pair would be valuable for this, if for no other reason, that there would always be a duplicate when one is broken, an accident not unfrequent. To these gauges I simply attach small copper pipes, so that one of them may be placed in communication only with the salt brine in the lower part of the boiler, and the other with the feed-water which is entering the boiler; the one then holds a column of brine, and the other of pure sea-water, and each inch of difference shows the degree of saturation.

Without the use of any attached scale, the engineer, by a little practice, comes to know in his particular vessel what difference in inches can be admitted without danger, and at what difference of height it is imperative to blow off. But it is convenient to have an attached scale.

It may be satisfactory to state, that the practical range of scale in an ordinary

boiler in the ordinary working, is 6 to 10 inches, a difference sufficiently great to be easily observed.

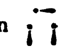
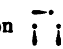
The rule of working them is nearly this:—Continue the operation of blowing off until, if possible, the difference of the columns is less than an inch; it will be unnecessary to blow off again until the difference is at least 6 inches.

As a practical rule, I find that it is necessary to blow off when the brine at the bottom has about three degrees of saltness. But this will vary exceedingly, according as the construction of the boilers is more or less judicious. When the heat is greatest in the lowest portion of the boiler, and the flues return above, they will be most liable to salt, and require the most frequent cleansing.

The following is Mr. Laurie's description of the instrument. The drawings give the details of the apparatus.—J. S. R.

Description.

The fact that the specific gravity of salt-water is greater than that of fresh, and that it increases with the degree of saturation, is what the operation of this instrument depends on; by its means two columns of water, the one feed and the other brine, are poised against each other, so as that any difference of weight betwixt these columns immediately becomes apparent by the lighter of the two requiring an accession in quantity to resist the upward pressure to which both columns are subjected. This is accomplished by having two common glass-gauge tubes close together, each of which is connected with a separate tube; that inside the boiler descends to the level of the water, the specific gravity of which is to be measured, and having either or both of these tubes so connected with the feed-pipe of the boiler, that by opening a cock one of the pipes will be filled with feed-water, while the other remains filled with brine, which cock being shut, the tubes remain so filled: but inasmuch as feed-water is of less specific gravity than brine, it will be forced up and stand in the glass tube at a higher level than the brine, which difference of levels increases with the saturation—and hence the index to judge of the saltness.

A, B, are two glass gauge-tubes; C, one of the tubes forming the connexion betwixt one of these glass gauge-tubes and a tube D, which descends inside of the boiler; E, the tube forming the connexion betwixt the upper ends of these tubes and the inside of the boiler; F, G, two cocks so made, as shown in the engravings, that by their means each of the tubes inside of the boiler may be shut off from the glass tubes, and also may be connected with the tube H, leading from the feed-pipe of the boiler; I, a cock affording the means of shutting off the tube E from the glass tubes with the tube K, leading to the bilge of the vessel; each of these cocks has a handle, and when the instrument is indicating, the three handles hang perpendicularly downwards. Sections of the cock at M N and O P, are given separately. To bring the instrument into operation, the three handles must first be put in the position  which has the effect of allowing the brine to flow right up the glass tube A, and out through the tube K, into the bilge of the vessel; this having been done for so long a time as that A and its tube inside the boiler be thoroughly cleansed and filled with brine, the handles are then to be put in the position , which, in like manner, cleanses and fills B and its tube inside the boiler with brine; finally, bring the handle of the top-cock into its original position, and put either of the lower handles horizontal, which forming a connexion of the feed-pipe with one of the tubes inside of the boiler, fills that tube with feed-water; thus there are in the two tubes inside of the boiler two columns of water of different specific gravities, the one being brine, the specific gravity of which is to be measured, and the other feed-water, the specific gravity of which is pretty nearly constant, so long as the temperature of condensation is the same, and does not vary much let the temperature of condensation be what it may; but, inasmuch as these columns of water are of different specific gravities, the pressure on the bottoms of them will force the lighter up the glass tube, until such a quantity of brine has followed it as makes it of equal weight with the other; and hence, in the two glass tubes, the water stands at different heights, the

magnitude of which difference becomes known by means of the scale fixed betwixt the glass tubes, and therefore also the degree of saturation of the brine.

The use of this instrument, which might be called a Salinometer, is not confined to this one object, for it answers thoroughly all the purposes of the common glass gauge, the position of the surface of water in the boiler being midway betwixt the surfaces of water in the tubes.

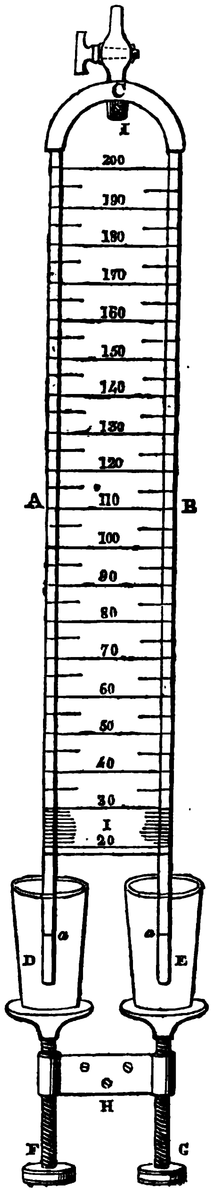
When either or both of the glass tubes is broken, put the handles in the position ! !, and nothing can escape from the boiler.

T. W. L.

DESCRIPTION OF AN INSTRUMENT FOR ASCERTAINING THE SPECIFIC GRAVITY OF FLUIDS—BY JOHN HAM, ESQ., C.E.

Sir,—I beg to forward, for insertion in your highly popular publication, the drawing of an apparatus for readily ascertaining the specific gravity of fluids, which I devised some months since, and find extremely useful in practice.

By having the scale minutely divided, or adapting to it a vernier, it is susceptible of a high degree of accuracy, and for all ordinary fluids, is infinitely superior to the gravity bottle and balance, and in many instances preferable to the common hydrometers, especially in commercial transactions, where rapidity and accuracy are essential points.



A and B are two glass tubes, from ¼ to ⅜ths of an inch bore, and of any convenient length; about 2 feet will be found sufficient for usual purposes; C a connecting brass tube and stop-cock; D and E two glasses, one for distilled water, the other for the liquid whose specific gravity is required; F and G, two milled-headed screws, carrying each a stand for one of the glasses; H, a bracket with two nuts, for supporting the screws and stands, F G; I I, the scale, divided into 200, or 2000 equal parts, or degrees.

The mode of using it is simply this: Pour distilled water into one of the glasses, and the liquid to be tried into the other, both at 60°, or any moderat

uniform temperature. Exhaust the air in the tubes—either by means of a syringe, or the mouth being applied at the stop-cock, C—until the lightest fluid is nearly at the top of one of the tubes; then bring the surfaces of the two fluids, in the glasses E and E, on a level with the marks, *a a*, on the tubes, by means of the screws, raising or lowering the stands as required; the heights of the fluids in their respective tubes will immediately give their relative gravities, convertible into water at 1000, by simple proportion.

I am, Sir,
Yours very respectfully,
F. HAM.

Norwich, Jan. 9, 1844.

ON THE MACHINES FOR RAISING AND LOWERING MINERS, AND ON THE USE OF THE IRON WIRE ROPE, IN THE MINING DISTRICT OF THE HARTZ. BY JOHN TAYLOR, ESQ., F.R.S., ETC.

As some things came under my notice during my recent visit to the mining district of the Hartz, which may be interesting to the Members of the Polytechnic Society, I will endeavour to communicate the result of some of my observations and inquiries.

In the first place, I was desirous of knowing whether the machines for raising and lowering the men, continued to answer their purpose satisfactorily, and whether, as the best evidence of this being so, they were extending in use. I found that they were spoken of by all the principal officers of the mines, in terms of great commendation. I heard of no adverse circumstances that had occurred in using them, and I understood that they were now applied in every situation that afforded facilities for erecting them.

I saw one in action which I need not describe, as you have a perfect account of the construction, in the reports of the society; but it appeared to me to be inferior to what has been executed at Tresavean, the brackets or platforms on which the men stand were small, and the iron loops for holding by were not, in my opinion, very conveniently arranged. The stroke of the rods, also, was much shorter than that proposed to be adopted in Loam's machine; still the arrangement seemed to be perfectly effective, and the ease with which the men seemed to step from one rod to the other, and were thus carried up or down, was very pleasing to witness, and had rather a striking effect in its appearance.

In one of these machines, which is carried to a great depth, it has been attempted to strengthen the timber rods, or to give them additional security, by attaching to them a wire rope. I doubt much whether this be a good way of accomplishing this purpose, and I had much conversation with our friend Mr. Jordan, the *Machinen Inspector*, on the subject. It is found that the wire rope when extended and stretched in connexion with the rod, being in a state of rest and exposed to the wet and to the heated air of the mines, soon oxidizes, and may thus become considerably weakened, in a manner that may easily escape observation, and thus a delusive appearance of strength may be relied upon.

As the wire ropes which are in universal use now in the Hartz mines, for drawing up the ores and waste, are not subject to oxidation in any degree that sensibly impairs their strength, this defect in another application of them was not foreseen, and the difference must, I conceive, be accounted for by the fixed state in the one case, and the constant motion in the other.

I suggested to Mr. Jordan that the oxidation might probably be prevented by a process now much used in France, but which I have not heard much of in England, and that is coating iron with zink, in the same way as it is covered with tin in the manufacture of tin plates. This is termed galvanizing the iron, and I know from the best authority, is very successful in protecting it from rust. It is commonly applied to wire work that is to be exposed to the weather; such as trellis work for gardens, &c., and is performed after the wire is woven into the forms required, and at a very cheap rate. It unites or solders the joints or crossings, gives the whole a very pleasing appearance, and is effectual in preserving it for a great length of time. For wire ropes that are extended in a rigid state, such for instance as standing rigging, it might probably be advantageously adopted, though it probably might not answer for those which are employed to wind on whim cages and to run over pulleys, and in which cases indeed it does not appear to be required.

The members of the Polytechnic Society are aware that the principle upon which the machines for raising men from the mines have been constructed, was suggested almost contemporaneously in Germany and Cornwall, without any communication between the inventors at either place, and it is one of numerous cases that might be adduced, where the merit of invention has been due to more parties than one.

I felt some interest in inquiring as to what led to the suggestion of this important application of mechanical power in Germany, knowing that in Cornwall it had its origin in the benevolent and generous exertions of some distinguished members of the Polytechnic Society, who, desirous of remedying a great evil, stimulated ingenious men to attend to the subject, by premiums offered for the best means of facilitating the ascent and descent of the men employed in deep mines.

In Germany the invention seems to have originated with an individual, who in contemplating the alternate motion of the two pump rods, which, as you know, are always employed in their shafts, when the power is derived from water wheels, saw that a body moving from one rod to the other, would be carried upwards or downwards according as the direction of this motion from the one to the other was managed. He proposed to take advantage of this for conveying the men to and from the deeper parts of the mines, the idea was approved, and was very shortly carried into successful operation.

So that it appears that in the one case the invention was produced by the desire publicly made known of lessening the labour and avoiding the injurious effects attendant on the general syetem of climbing by long ladders; while in the other the idea of the mode by which men might ascend and descend without exertion first occurred, and the value and importance of the application was subsequently thought of.

In the mines of the Hartz nothing engaged my attention more than the universal employment of wire ropes, for drawing the ores and waste from underground; this appears to me to be one of the most important improvements in the economy of mines that has for some time been made, and as it is but now beginning to make progress in this country, I am induced to notice it in the hope that what experience may have been gained in Cornwall may be gathered at the next meeting of the society, that the matter may be discussed, and the results made more generally known.

The merit of this invention is due to Mr. Albert, the able and enlightened principal officer of the mining administration at Clausthal, who gave his zealous attention to this subject, and after overcoming many difficulties, succeeded in bringing them to their present perfect state.

The first information respecting the use of wire ropes afforded to the English miner, was by Count Brenner, *Oberberg Hauptman** of Hungary, by a paper which he communicated to the British Association at Newcastle, in the year 1838, at the meeting of which he was present, and did me the honour to ask me to read it for him. The subject did not appear to me to attract the attention I thought it deserved, and I believe I mentioned it in Cornwall at a subsequent meeting of the Polytechnic Society, and some information was in consequence obtained from Germany respecting it; but it was not until the return of Professor Gordon from that country, that any attempt was made to avail ourselves of the improvement.

Of late, several persons have engaged in the manufacture, and great rivalry seems to exist as to claims to patents, and to superiority of quality. Some are in use in Cornwall, and there may now have been time enough to have gained a certain degree of knowledge of the value of this invention.

The mines in the Hartz, are, as you know, very deep, the stuff is drawn by water engines, mostly constructed with double bucket wheels, and often at some distance from the shafts; the kibbles are large and heavy, these you see every where raised to the surface by wire ropes, the diameter of which seems so small when compared with what one has been used to look at, as to wear a very remarkable appearance.

The saving of expense when compared with the use of hempen ropes is stated to be very great, and accords very nearly with the account given by Count Brenner in the paper alluded to. The ropes I saw were made of twelve wires, but for great depths the upper part is somewhat stronger. The pulleys over the shaft are 7 or 8 feet in diameter, and some stress is laid on this, and I do not consider it a fair trial of these ropes to work them over pulleys of much smaller diameter.

I was however surprised when I visited the Iron Works at Ilsenberg, at Rothehûte, and at Königshüte, to find wire ropes used on cranes in the foundries, and in machines for raising iron ores perpendicularly in tram wagons, to the top of high furnaces. In these cases the barrels on which the ropes wound, and the pulleys over which they worked, were necessarily very small in diameter, they seemed as pliant as they need be, and to have sustained no injury in use. I was informed that for such purposes the ropes were formed of a greater number of smaller wires, by which it was found that they endured the bending to a more acute angle without injury. I notice this to show that they may be adapted to almost every use to which cordage is commonly applied.—*Trans. Royal Cornwall Polytechnic Society.*

* "Oberberg Hauptman" is the title of the chief director of the mines of a country.

PROGRESS OF MARINE STEAM-ENGINE IMPROVEMENTS—THE DOUBLE STORIED BOILERS.

Fig. 1.

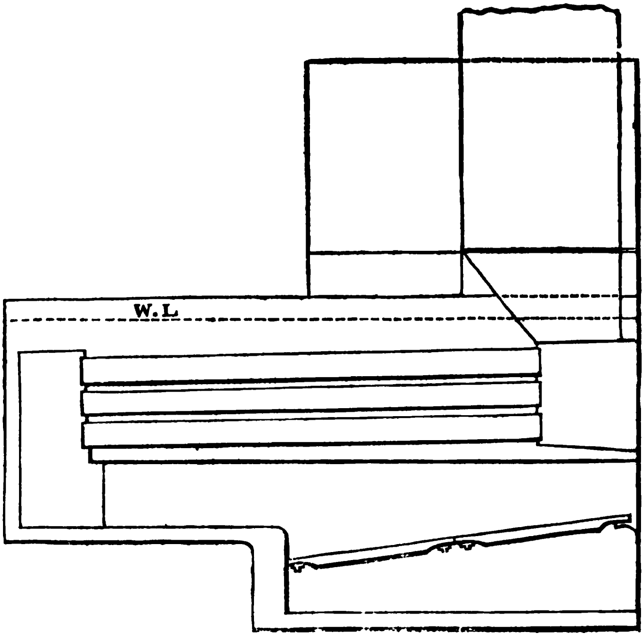
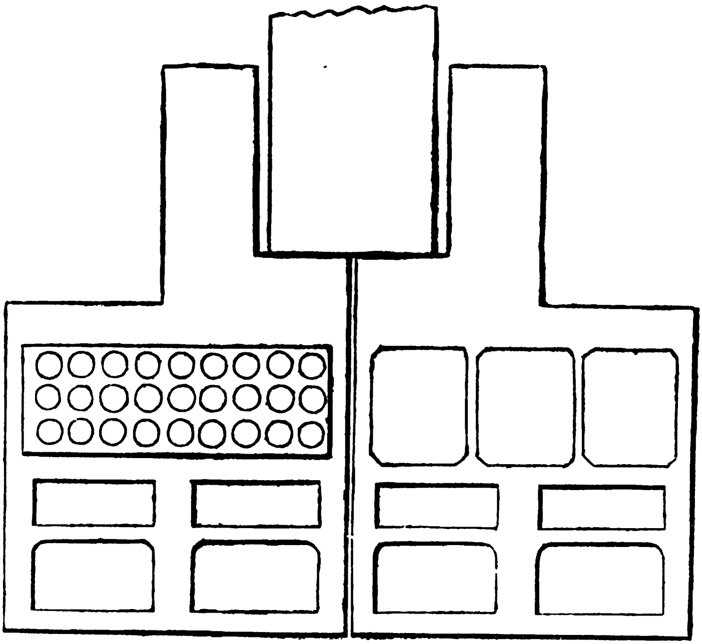


Fig. 2.



Sir,—During the past year your readers must have observed in the various detailed accounts which your pages have contained of steam marine machinery, the great saving of weight and space, which has been accomplished beyond any thing known four or five years ago, and must naturally have been led to enquire by what means this great improvement has been brought about? The answer may be given in few words:—by the substitution of direct action engines for those on the side-lever plan, and of tubular boilers for the old common flue boilers. The side-lever engines have now scarcely a single advocate, and they are almost, if not quite, laid on the shelf. Not so the common flue boilers; they have many friends still, who are endeavouring to keep up the unfounded prejudice which existed for so long a time against their tubular brethren. A great stride was made when, in the boilers of the *Great Western*, the flues were placed over the fires, making what are called double storied boilers. This arrangement, by which a very great saving of weight and space is effected, has been adopted in almost every large vessel constructed since that time, and was certainly an immense improvement upon the old straggling flue-boilers. It was to them what the last arrangement of tubular boilers, with the tubes behind the fires, is to their predecessors.

The plan to which I allude is that with the tubes placed over the fires. The writer of the notice of the *Firebrand* in No. 1064, is certainly in error in ascribing the invention of this particular description of tubular boiler to Mr. John Seaward. I send you herewith drawings of a pair of 70-horse boilers on this plan (see opposite page), which were designed by Mr. Joseph Maudslay, and manufactured by Messrs. Maudslay and Field, in October, 1840, and I believe I am justified in saying that no such arrangement as this was in use before that date. The tubes (of copper) were fixed at the ends with steel rings. I am, Sir,

Your constant reader,

M. J. E.

MODERN SHOEMAKING.

Sir,—Your correspondent "T. E. B." in his communication (in No. 1065,) seems to have misapprehended my meaning, which may perhaps have arisen from the obliquity of my explanation. I never intended to advocate so fallacious a principle as that tight or short shoes were the *ne plus ultra* of the Crispian art; the latter abomination especially, which I did not touch upon. Short shoes are not only ugly and stumpy, but cause more deformities than either over-large, or over-tight shoes—pressing upon the tender quick, and forcing the inside joint out of its position (the chief cause of bunions, and of crippled toes that rise or ride)—curtailing a proportion, that, if artificially increased, becomes pleasing to the eye by narrowing in appearance the breadth of the foot. While condemning the mistaken notion of wearing large shoes, I did not intend to gallop to the opposite extreme, and advocate tight ones; but a proper "well-made" (fitting) article. When I said that in nine out of ten cases the tight shoe was cast aside, I meant the really tight shoe, (not what is usually denominated a tight shoe,) and "T. E. B." seems sensible of this by the addition of "ill-made" to his description of the tight shoe.

The oppression on the tendons of the muscles stops the circulation of the blood when a tight shoe is worn, preventing the natural action of the joints, and rendering the wearer incapable of placing it fairly on the ground—from pain, if he has a tender bony foot, and if he has a fleshy, anti-tender foot, from a benumbed sleepy sensation, which a warm fire will soon awake, swelling his veins with an exquisite pain, something akin to bursting. Now if a bootmaker has the good fortune to "soft sawdur" a weak vain mortal into wearing such a "fit," it is, as I before said, invariably cast aside on the principle that "sufficient for the day is the evil thereof." It is therefore seldom the ultimate cause of corns, which owe their origin to the "nice and large," "loose and roomy" shoes that when first "tried on," feel comfortable, but which, after wearing for a short time, especially when descending steep places, become painful, an effect commonly attributed to tightness—a "make-shift" sort of tightness, which is generally tolerated from its being only transitory. The larger they are made the worse they become, which I have often seen remedied by an extra pair of stockings, or stuffing the toes with cotton wool, to prevent the foot wriggling forward. To prevent, therefore, the constant attrition of the protuberating bones of the joints of the little toes (where corns are chiefly seated) against the sides of the shoe, I would have the foot firmly grasped in a close-fitting shoe—preventing this friction by applying pressure in proper proportion on particular parts, according to the formation of the foot; this would add grace and firmness to the carriage in walking, as the wearer would "feel his feet." The heel, for instance,

which is subject to much pressure, is seldom afflicted with corns, although it protuberates; but if the shoe should be too large, the heel rises in the action of walking, creates a blister, (an embryo corn,) which the wearer seldom perfects, from its extreme pain.

Gay, in his "Trivia," had a crude notion of this when he says—

"Should the big last extend the shoe too wide,
Each stone will wrench th' unwary step aside."

I have not had an opportunity of reading Mr. Aston Key's remarks, but Mr. Wardrop, Mr. Liston, and Sir B. Brodie attribute corns and bunions to friction as much as pressure. Friction cannot occur where the foot is properly pressed. This is supported by Mr. Erasmus Wilson, in his Lectures on diseases of the skin, in which he states that "the exciting cause of corns is friction, occasioned by the coverings for the feet being either too large, too loose, or too hard." Hence, this same friction will have the same effect, whether resulting from the dangling of heavy pendants attached to earrings, from the pressure of the bone of the stays, or from the rubbing of the leg of a post-boy against the pole of the carriage. Moreover, it is not an uncommon occurrence for infants who have never worn shoes, to have corns, (Dr. S. Cooper;) and for corns to leave persons suddenly, although wearing the same kind of shoes and stockings as before, (Dr. J. G. Graham;) also for persons to have corns on one foot, and not the other, although wearing straight shoes, which they have alternately changed. All these facts go to prove that the cause of corns is not altogether confined to tight shoes, the size of which is not altered by meteorological influence, which all old women acknowledge in the words of Dean Swift—

"The coming shower your shooting corns presage."

The shoe, instead of becoming tighter, is likely to become softer from the approach of damp.

Female servants, albeit they wear tight shoes out of doors, if they can, are no criterion, and, like sailors afloat, wear in doors the "slip-slop" which I condemn; they are therefore both generally subject to corns. The same with sedentary people, high and low, and cozy folks, who comfortably envelope their feet in warm cloth, carpet, or worsted house-slippers, wearing them on the warm hearth-rug, close to a blazing fire. These "comforters" are *very wisely* exchanged, when going abroad into an atmosphere very many degrees colder, on cold damp flags, for a pair of light tanned leather shoes. These people always have tender feet, complain that new leather "draws" them, adopt "*pannus corium*," cloth, chamois, buck or doe skin, and other effeminate conceits, which, when once adopted, prevent the wearer from being ever able to wear with comfort the "recreant calf," be the shoemaker ever so scientific. And as none of the aforementioned exotics are adapted for wet weather, they are constantly embroiled in their endeavours to return to the old *utile*, condemning the stupid shoemaker, execrating the weather, deploring their tender extremities, never judging that the foot requires as much training as any other part of the body.

In reference to the French, and the great care they take in developing the form of the foot when young, the "Bootmaker" is perfectly correct in his remarks. The same mechanical machine that Napoleon admired in our army, and regretted the want of in his own, will not be found in shoemaking. The French workman identifies himself with his master's interest, catches the master's idea, and works it out, careless of the time or trouble, but pleased with the perfection which is the result. He is careful in lasting, or drawing the uppers scientifically over the last, before he sews in the stiffner behind, or the linings at the side, which the soft French leather greatly facilitates, (whether from bad tanning, or killing their cattle so young, I cannot say, but certainly the superior quality of the French leather is its porosity, which will not resist wet, but sucks it up like a sponge.) The English workman, who, as a stitchman, is far superior to the French, lasts the uppers, lining and all, perhaps tightly or loosely, as the humour takes him, sometimes more in one part than another, so that the most perfect model is apt to misfit, a climax he disdains to take any interest in; hence boots made off the same lasts by different, and sometimes by the same man, will fit in a very opposite manner.

With respect to measurement, it would be advisable to take the circumference of the foot by placing the beginning of an inch tape measure a little beyond the great toe-nail, as the second toe is naturally the longest, passing the measure round the protuberating part of the heel, and bringing it up to the point of the beginning of the measure at the toe. This, averaging from 21 inches to 24 inches, will give an exact length of the foot in a standing posture better than the usual "size-stick" used by shoemakers, as the foot cannot stand firmly on its narrow surface, from the extreme nervousness of the sole of the foot. The object of the draft is to give the maker a bird's-eye view of the shape of the foot, either to make a crooked last for pigeon-toed feet, or a straight last for the fan-like spread of the toes in a straight foot. I am, Sir, yours, &c.,

HENRY O'SHAUGHNESSY.

SOCIETY OF ARTS—TRANSACTIONS FOR THE SESSIONS 1841-2, 1842-3. VOL. LIV.*

It happens rarely in the history of Institutions depending for their prosperity on popular support, that they have any second spring time. They commonly rise, decline, and fall, and—there an end. Our London Society of Arts seems destined to prove a remarkable exception to this usual course of things. Some three years ago it was generally considered as *in articulo mortis:* its volume of annual transactions, once of a very respectable bulk, had dwindled to a skeleton thinness; its exchequer was almost empty; its sittings deserted; its members greatly diminished in numbers, and wholly bereft (to all appearance) of zeal or care for the Institution; and its reputation with the public was down to zero. But since then (we pass over one change in the management, which advanced matters only from bad to worse) the Society has had a new president (Prince Albert), several new heads of departments, and a new secretary (Mr. Whishaw); and since then it has also adopted a new system of action—opening its doors to useful inventions and improvements of every class and degree, instead of rigidly excluding, as heretofore, all that had the stamp of "patent" upon them. The consequence of this infusion of new blood and new views, is a state of revival and rejuvenescence not more unhoped for, than it is gratifying to witness. The annual volume begins to exhibit something like its former goodly proportions, and, the truth to speak, a good deal more than the old average portion of merit; the Society's sittings are again well attended; the number of members on the increase; the exchequer replenished; and the reputation of the Society once more in the ascendant. May these be no illusory symptoms, but unfailing proofs of the commencement of a new and long career of eminence and usefulness!

The new plan of receiving communications on patent inventions, though it works upon the whole, well for the Society, by making it an arena for the discussion of the merits of things, in which large pecuniary and personal interests are commonly involved, has an effect on its Transactions, as a *published work*, which is not so favourable. As the public are made acquainted with most patent inventions of importance as soon as specified, either through our own or other scientific journals, they must of necessity have lost everything of novelty, before they can be served up again through the medium of the Society's Transactions. Fuller accounts the Society may give, though not very likely more impartial ones, seeing that they must in general be furnished by the patentees themselves; and in any event they can never have that freshness which is so essential an ingredient in new publications.

As it is, the Society having admitted patent inventions within its pale, and so far subscribed to the policy of the existing law, which recognizes no property in any invention which is not patented or (under the recent Designs Acts) registered; the Committee of Correspondence and Papers should not have admitted into the pages of the present volume the gross attack which is made by one of their correspondents on some manufacturers of Liverpool, for making free (as they had a right to do) with a certain invention which had been neither patented nor registered. The case is this:—a Mr. Charles Cameron discovers a new mode of discharging the colour from palm oil, by which a saving of 18*s*. per ton may be effected; he sells a description of this process to one house for 5*l*., and (though he does not admit as much) most probably to others for a like sum; he then applies to the Society of Arts to have a premium awarded to him for his discovery; and it is thus he speaks, and that the Society allow him to speak through their published Transactions, of the treatment he has experienced:—

"You may form some idea of *the description of character* I have to deal with when

* Published at the Society's house, Adelphi, December 1843, pp. 230, 8vo. With numerous engravings.

I tell you, that four of the manufacturers here have adopted my plan, without the slightest acknowledgment to me. It cannot be kept a secret; I have no legal redress; and therefore must *submit to a robbery of my property.*"

If an inventor will not go through those formalities by which alone any "*property*" or *legal estate* in an invention can, according to the laws of his country, be established; if he voluntarily part with his secret to this one and that one, so that he has no longer any hold or command over it, he can have no right to talk in this way, whatever may befall it. Where there was no "property," there could be no "robbery." The expenses of the neglected "formalities" may be too great, (as doubtless they are,) but that is another question, and one which is not raised by the shape in which Mr. Cameron's case is here brought before us.

The following is Mr. Cameron's description of the process referred to:—

"About six years ago a process for discharging the colouring matter of palm-oil was introduced into the soap manufactories here, which was as follows:—Into a strong cast-iron pan, (built in the usual way, with a furnace below it,) the manufacturers put two, three, or more tons of oil, according to its capacity; they then, by means of the fire below, increased the temperature of the oil to 450°; the result was, that the colouring matter was completely destroyed. But after working on it in the most careful manner, they were at last obliged to abandon it, for the following reasons:—

"1st. By the time that the whole body of the oil was raised to 450°, the bottom of the boiler was heated to above 600°, and, consequently, the portion of oil in contact was decomposed, and being converted into gas, frequently caused explosions to take place.

"2nd. The effluvium from the decomposed portion was insufferable.

"3rd. If not immediately run off on the colour being discharged, they frequently procured a black colour from the charred oil being mixed with the other.

"The process was cheap, but from these reasons, and the danger attending it, they were obliged to relinquish it.

"I have stated the above, that you may the better understand the improvement I have effected in the process.

"About four months ago I was induced to make some experiments to ascertain at what point of temperature the colouring matter began to give way, when I satisfactorily found that it began to change at 230°, and on continuing the process to within 2° or 3° more or less of that temperature, with continued agitation, it gradually lost its colour, and at last became as white as home-made tallow, and of a hardness superior to any imported. I then fully established the fact, that a low temperature, (230° instead of 450°,) length of time, and agitation (agitation was not employed in the old process) removed all the difficulties that prevented its former success.

"The process which I recommend, and which is now acted upon here, may be thus described:—A cast-iron pot is provided, containing from three to four tons of oil, with the ordinary furnace below it, and a horizontal revolving fan of sheet-iron placed within it for agitation, power being obtained from a steam-engine, with a speed of six revolutions per minute. In the absence of an engine, a wooden rake may be employed. The oil is then, by means of the fire, raised to a temperature of 230°; the fire is then withdrawn from below, and high-pressure steam is introduced from a boiler (15 lbs. pressure on the square inch of the valve,) by means of leaden pipes, two or more, (according to the size of the boiler,) of 2 inches diameter. By this means an equable temperature of 230° is obtained, without any danger of decomposing the oil, and the process is continued until the colour is completely gone. A vessel containing four tons will require ten hours to complete the process, at an expense of only 2 cwt. or 3 cwt. of slack to each ton of oil.

"It appears to me that the colouring matter is discharged by the absorption of oxygen from the atmosphere, as oil at a high temperature is known to have a strong affinity for oxygen at a high temperature, and hence agitation is essential, so as continually to present a new surface."

We add some other extracts from the volume before us, which, though by no means the best which it could supply, are convenient for extract, on account of their not requiring any engravings for their illustration, and will suffice to evidence the great improvement which has taken place in the quality of the Society's Transactions;—

ON THE CONSTRUCTION OF FLUES, ETC.

BY J. SYLVESTER, ESQ.

To remedy the evils attended upon the ordinary construction of flues, fire-places, and grates, Mr. Sylvester proposes to build every

flue perfectly vertical; each flue for every fire-place, in all the stories, not only to ascend to the chimney-top on the outside, but to be continued down into the basement in lines parallel to each other from top to bottom, the fire-place or grates not being *under* the flues, but projecting in front of the chimney breast. The smoke from the fire is made to pass through an aperture into the flue at the back, which opening can, when the fire is not in use, be closed by an air-tight sliding door, while another, opening into the flue under the fire-grate, allows the ashes, dust, and other residue from the fire, to be cleared away into the descending or tail-flue, whence it falls to the bottom thereof in the basement story.

The flues being built perfectly straight and smooth, all lodgment of soot is prevented, and, consequently, the evils attendant on the contraction of the flue and falling of dirty matter into the apartment, have no longer existence, while the defective action of the chimneys, arising from this cause, is, as a necessary consequence, done away with.

This concerns the flue considered as a means of carrying away the smoke, and causing the perfect action of the fire; but an equal, if not a greater advantage consists in doing away with the necessity of sweeping each flue into the fire-place of the room it belongs to, with the accompanying evil of a long preparation of the room by taking up carpets, covering furniture and books, removing ornaments, &c., &c., to the great destruction of comfort and loss of time.

All these formidable evils are completely avoided, since by this means it is merely necessary when a chimney requires sweeping to close the door at the top of the grate with which the flue communicates, and the sweep may go into the basement story, open the door at the bottom of the tail or descending flue, and take away the soot and ashes there collected. He may then, by the use of the machine, since climbing boys are no longer permitted, brush down, from top to bottom, any small portions of soot that may hang to the flue, when the whole can be removed without the slightest interference with the room to which the flue belongs. The whole of the flues in a stack may be swept at the same time with as little inconvenience as *one*, since they all descend into one chamber and open at the same level.

It is worthy of remark that the flues being quite straight there are no shoulders, as in tortuous flues, for the soot to lodge upon, and, consequently, the operation of sweeping will not be required *nearly so often* as with the ordinary chimneys, and the removal of ashes may take place at any distant intervals of time, instead of two or three times a-day; for instead of the ashes being carried through the rooms, they are made to descend the tail-flue, and are thence carried away with the soot.

ON A PATENT TUBE FOR LOCOMOTIVE AND MARINE BOILERS—BY MR. JOB CUTLER.

Tubes were first introduced into steam-engine boilers by M. Seguin; it has since been found that the cost of the original tubes, and also that of repairing them, has been excessive, and that every engine, according to Tredgold and our best authorities, has required to have the whole of the tubes removed and replaced by new ones about once in every two years; and this, exclusive of the tubes used in the intermediate time for repairing or replacing those tubes which, from being nearest the fire, had been worn out in one quarter the time of the others.

Mr. Cutler's tubes may be made of common iron, but he prefers that they should be made of what is termed best, or charcoal iron, as they would be rendered easier to work, and more durable. The tubes may be welded in the ordinary way, only, instead of making them (as iron tubes have heretofore been welded, for gas and other purposes) with a jump joint, he makes them with a lap-over joint, which presents a stronger resistance to the force of both fire and steam than does the former. After the tubes have been welded he inserts a bright steel mandril or triblet, and then draws them through a hole or wortel, commonly called a die or bed, and which is placed upon a draw-bench; the drawing is performed by the end of the tube being inserted through the hole or bed, and then grasped by a pair of pliers attached to an endless chain, and the motion being thrown on, it is drawn through in the usual way. The whole length of the mandril over which the tube is drawn does not pass through the hole or wortel, as in this case there might be a difficulty in extracting it, or at least, it would occupy some time in so doing, but it is made stationary, with the triblet end passing a few inches through the hole or wortel, and the tube is drawn down and off the mandril. This process has the effect of straightening the tube, laying smooth any blister which may have risen upon the iron in its hot state, rendering it perfectly cylindrical, and laying the grain all one way, and rendering it closer, thereby increasing the consistency and durability of the tube. By this method, also, the tubes may be rendered bright, and have a polished appearance, or after having been drawn as above described, they may be blued in the usual manner, and which appearance is mostly preferred by engineers. The end upon which has been place

the gripe being then cut off, the tube is fit for use. These tubes are sold at about 6*d*. per lb., which is a reduction of 8*d*. per lb. upon the price charged for brass tubes. The following calculation is presented, as representing the nature and amount of the saving:—

	£	s.	d.	£	s.	d.
Brass Tubes						
One set of 130 tubes, 30 cwt., at 1*s*. 2*d*. per lb.	196	0	0			
Say, during two years, 50 required for repairs, 12 cwt., at 1*s*. 2*d*. per lb.	78	8	0			
				274	8	0
Iron Tubes.						
One set of 130 tubes, 23 cwt. 24 lbs., at 6*d*. per lb.	65	0	0			
Required for repairs, 30 tubes, 5 cwt. 1 qr. 2 lbs., at 6d.	15	0	0			
				80	0	0
Difference per engine				£194	8	0

The great difference in weight is caused by the difference in the specific gravity of the two metals, and also by the difference in thickness, as the iron, being of a much more durable nature, can be made much thinner; as if brass is used at 12 of the wire-gauge, iron tubes may be made of 13 or 14 of the wire-gauge; but even supposing the weight to be the same, the difference in a set of tubes would be—

	£	s.	d.
Brass tubes, 30 cwt., at 1*s*. 2*d*. per lb.	196	0	0
Iron tubes, 30 cwt., at 6*d*. per lb.	84	0	0
Being a saving of tubing in every engine of	£112	0	0

So that if the London and Birmingham Railway Company have 100 engines, and use in each engine every four years, only 30 cwt. of tubes, the saving to them by using iron tubes would be, for the four years, 11,200*l*.

An object which Mr. Cutler considers of great importance is, that in consequence of the iron being thinner, and so much better a conductor of heat than brass, the steam would be generated much quicker, thereby effecting a great saving of fuel, and affording a greater capability of raising the steam at any period in a shorter space of time, when wanted in a hurry, or when, by an injection of too great a quantity of cold water, the rarefaction of the steam is lessened.

CASELLA'S PLUVIAMETER.

The pluviameter, or rain-gauge, invented by Mr. Casella, consists of a hollow cylindrical vessel, 23 inches high, and $3\frac{7}{12}$th inches in diameter, mounted upon a hollow base forming the segment of a cone, whose lower diameter is 13 inches, upper diameter $3\frac{7}{12}$th inches, and height 8 inches; this may be filled with dry sand, or other substance, to give steadiness to the apparatus, which is furnished with three pointed legs for the purpose of fixing it into the ground when required. At the top of the vertical cylinder is an open basin, of the same form and size as the base, perforated in the bottom with an aperture, equal to $\frac{1}{12}$th of an inch in diameter, through which the rain collected in the basin descends to the bottom of the cylinder, and the height of the column of water so collected is shown by a graduated glass tube attached to the cylinder, and communicating with it at the bottom. The tube is half an inch in diameter internally, and the graduation on the tube is in inches and tenths of an inch.

The collective areas of the cylinder and glass tube being equal to $\frac{1}{10}$th the area of the basin at the top, a scale is readily formed for ascertaining the depth fallen on the surface in a given time; and Mr. Casella intends to graduate the scales in future so as to show at once the actual depth of rain fallen without any reference to a table.

The mode of adjusting the pluviameter is to fill the cylindrical vessel exactly up to zero on the scale, the rain falling into the basin, and descending into the cylinder, elevates the water in the cylinder and glass tube simultaneously, and thus the depth is found by an inspection of the scale.

On adjusting the gauge for a second experiment, it is merely required to draw off the water to zero by the cock fixed in the side of the cylinder.

SILVER PLATING AS PRACTISED AT SHEFFIELD. BY MR. POTTER, JUN.

Plating on copper was first introduced in the year 1742 by Mr. Thomas Bolsover, a member of the Corporation of Cutlers, at Sheffield, who, when repairing a knife-handle, composed partly of silver and partly of copper, suddenly thought that it might be possible so to unite the two metals as to form a cheap substance, which, presenting an exterior of silver, might be used for the manufacture of several articles hitherto made entirely of that metal. It was not till about forty years after the introduction of Mr. Bolsover's plan that the ornamental parts of plated articles, called mountings, were constructed of silver. This great improvement caused the manufacture of plated wares to become one of the staple trades of Sheffield. There are two important features in the process of silver-plating, the one a perfect adhesion of the two metals, the other a protection from wear of the prominent edges by friction.

The process of manufacturing plated articles may be described as follows:—

An ingot of copper being cast and the surfaces carefully prepared by filing, so as to remove all blemishes, and a piece of silver, also having one surface perfectly cleaned, are tied together by means of iron-wire. A paste of borax and water is then passed round the edges with a quill, and the mass being placed in a common air-furnace, is heated to a proper temperature, which is ascertained by means of a small aperture in the door. As soon as the union of the two bodies is effected (which is known by the oozing of the metal when the fusion of the two metals has taken place), the bar is removed from the furnace. The quality of the silver used in the process is what is termed standard, containing about 18 dwt. of copper, to the pound troy. The effect of this alloy is to render the articles harder, and consequently more durable.

The ingot being thus prepared, the next operation is to form it into sheets, which is effected by passing the bar several times through large cylindrical rollers, generally moved by steam power; the lamination which the silver undergoes during the operation of rolling shows the perfect union of the two metals.

The dies for forming the ornamental parts of plated articles consist of blocks of steel, on the face of which the pattern of the ornament is accurately drawn, after which the dies are moderately heated in an open fire, and then placed upon a leathern sandbag; the die-sinker then proceeds to cut out the ornaments with hammer and chisel. When sunk to the proper depth, the surface of the sinking is dressed off and prepared for the ornaments to be stamped in.

The stamping machine (of which a small working model was exhibited) consists of a vertical frame of iron, the uprights of which are formed with grooves in which the hammer or drop slides. The foundation of this machine consists of a square stone, on the upper surface of which is fixed an iron anvil, to which the uprights are firmly attached. The hammer is raised by a rope passing over a pulley fixed in the head-piece of the frame. The die is placed on the anvil immediately under the hammer, and kept in its proper position by screws. A luting of oil and clay is placed round the edge of the sink of the die, and melted lead is then poured into the cavity. When cool the hammer is allowed to fall upon the lead, to which it firmly adheres by means of a plate roughed as a rasp, which is called the *lick-up*.

The silver used for the purpose of the mountings is also of standard quality, and is rolled to the required thickness; several pieces of the requisite size are then placed between pieces of copper of the same substance, and put upon the face of the die. The hammer is then raised and allowed to fall gently upon them. This operation is continued for some time, gradually increasing the fall of the hammer, and diminishing the number of pieces struck, until they are forced to the bottom of the die; it is necessary occasionally to anneal the mountings.

The mounts being struck as described are now filled with solder, consisting of tin and lead, and afterwards secured by wires to the article to be ornamented, the body being covered with a mixture of glue and whiting to prevent the solder from staining the surface; they are then soldered on by means of a gas blow-pipe.

The article is next boiled in a solution of pearl-ash or soda, and scoured with fine Calais sand. The mounts are polished by a lathe, as in the case of silver articles, with rotten-stone and oil, then cleaned with whiting, and finished with rouge; a scratch-brush of brass-wire is used for deadening the parts required, and the plain surfaces are burnished with tools of blood-stone or steel, soap and water being used in this operation, which is performed by women.

NOTES AND NOTICES.

The Great Britain.—"All sorts of reports," says the *Bristol Mirror*, "of a mischievous tendency, are being most industriously propagated respecting the removal of this ship. At one moment we hear that the water is to be raised high enough to drown the city; at another that gentlemen are about to hire kitchens and cellars, for the purpose of depositing goods, with the intention that they should be swamped, and the value recovered from the Dock

Company; at another that the walls of the outer lock into the basin are to be pulled down altogether, and the upper lock treated the same way; at another that the gates are to be removed, and are too weak to be put back again; at another that the trade of the port is to be shut up for a month: at another that the expense of removal will be 30,000*l.*; and last, though not least, that the *Great Britain* is a great mistake, and is, until the iron with which she is composed is altogether decomposed, to remain in the Port of Bristol." Our contemporary then proceeds to refute these various rumours in detail, and concludes with expressing the strongest confidence that she will be undocked without difficulty, and at a very trifling expense. She is advertised to commence in May next to run alternately with the *Great Western*, between Liverpool and New York.

Animal Fat.—As many doubt the correctness of Liebig's theory in regard to the consumption of animal fat by the oxygen of the atmosphere taken into the blood-vessels by the action of the lungs, we copy the following "curious fact" from the *Columbia (S. C.) Advocate*:—"Some two months ago, Mr. James Kyles, of this place, missed a favorite pig, which, as it was very fat, he supposed some lover of fat pigs had appropriated to his own use, and gave it up for lost, until last Tuesday, when he commenced the repair of his house, and on raising the floor he found his pig still breathing, after at least fifty-eight days of entire abstinence from food or drink. The pig is still living, and able to take a little meal and water. A number of the most respectable persons can attest the above fact. This pig lived upon the same principle, or by the same warming and nutritive process that sustains the vital functions of a bear during his hybernation. The fat of the pig or bear is slowly consumed by feeble respiration by the chemical action of oxygen gas, like the oil in a lamp with a small wick, and a partial supply of that element in common air which supports combustion."

Artificial Ultramarine.—Of all the achievements of inorganic chemistry, the artificial formation of *lapis lazuli* was the most brilliant and most conclusive. This mineral, as presented to us by nature, is calculated powerfully to arrest our attention by its beautiful azure blue colour, its remaining unchanged by exposure to air or to fire, and furnishing us with a most valuable pigment (ultramarine), more precious than gold. Analysis represented it to be composed of silica, alumina, and soda, (three colourless bodies,) with sulphur, and a trace of iron. Nothing could be discovered in it of the nature of a pigment, nothing to which its blue colour could be referred, the cause of which was searched for in vain. It might therefore have been supposed that the analyst was here altogether at fault, and that, at any rate, its artificial production must be impossible. Nevertheless, this has been accomplished; and simply by combining, in the proper proportions, as determined by analysis, silica, soda, alumina, iron, and sulphur. Thousands of pounds weight are now manufactured from these ingredients, and this artificial ultramarine is as beautiful as the natural, while for the price of a single ounce of the latter we may obtain many pounds of the former.—*Liebig.*

Substitute for Steam.—*La Réforme* announces that an operative at Ruel has discovered a substitute for steam. The experiment is to be made in a few days on the Versailles railroad. "Figure to yourself," says the *Réforme* "an enormous wheel, five yards in diameter, between the spokes of which you place a horse with his rider. This large wheel being fixed on four ordinary wheels, placed on the rails of a railroad, it is sufficient to turn the large wheel to make the carriage advance. But what motive force does the inventor employ? It is the horse placed in the interior of the wheel, and yoked, by means of two bars of iron placed perpendicularly under the axle. The horse, by drawing, causes the wheel to turn in the same manner as a mouse or a squirrel in a cage. In order to permit the horse to enter into this singular wheel, it has been found necessary to dig an excavation near the station of the railroad, into which the horse is let down. The inventor says that he can modify his wheel so as to admit three horses, and that, in that case, the heaviest train may be propelled along a railroad with a velocity more rapid than that caused by steam."

Peopling the Islands of the Pacific.—Mr. Redfield, an American writer, in an able article recently published in *Silliman's Journal of Science*, states his conviction, that a knowledge of the currents and winds of the Pacific will solve the question of the peopling of its islands from the Asiatic Continent, in opposition to the long-urged objections of the trade winds. As corroborative of his opinion, Mr. R. says:—"A case is still recent, where the wreck of a Japanese junk, with its surviving crew, was drifted the entire distance to the Sandwich Islands, thus completing nearly half of the great circuit of the winds and currents of the North Pacific. Near the equator, the north-west monsoon of the Indian Pacific affords an additional means of transport, extending, according to the recent enquiry, at one portion of the year, as far eastward as the Society Islands, or more than half the distance from the Indian Ocean to the coast of South America."

Points of danger in Thunder Storms.—If out of doors, trees should be avoided, and if, from the rapidity with which the explosion follows the flash, it should be evident that the electric clouds are near at hand, a recumbent posture on the ground is the most secure. It is seldom dangerous to take shelter under sheds, carts, or low buildings, or under the arch of a bridge; the distance of 20 or 30 feet from tall trees or houses is rather an eligible situation, for should a discharge take place, these elevated bodies are most likely to receive it, and less prominent bodies in the neighbourhood are those likely to escape. It is right also to avoid water, for it is a good conductor, and the height of a human being near the stream is not unlikely to determine the direction of a discharge. Within doors we are tolerably safe in the middle of a carpeted room, or when standing on a double hearth-rug. The chimney should be avoided, on account of the conducting power of the carbon deposited in it; on the same principle gilt mouldings, bell-wires, &c., are in danger of being struck. In bed we are tolerably safe, blankets and feathers being bad conductors, and we are consequently, to a certain extent, insulated. It is injudicious to take refuge in a cellar, because the discharge is often from the earth to a cloud, and buildings frequently sustain the greatest injury in the basement stories.—*Noad's Lectures on Electricity.*

A neglected Patent.—In order to obviate the breakage of coals upon the River Tyne, occasioned by the fall from the ordinary spouts to the vessel's hatchway, Mr. W. Chapman, about the year 1800, took out a patent for the drop, now so universally used, by means of which the wagon is lowered down close upon the hatchway of the vessel. Manifest as this improvement appeared, it was allowed to sleep entirely unnoticed, until within a short period of the expiring of the patent, when it was applied in 1810 by Mr. Benjamin Thompson, at Wallsend, and was afterwards generally adopted.

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MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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Edited by J. C. Robertson, No. 166, Fleet-street.

EDWARDS' RIGHT-ANGLE-BEAM STEAM-ENGINE.

Fig. 1.

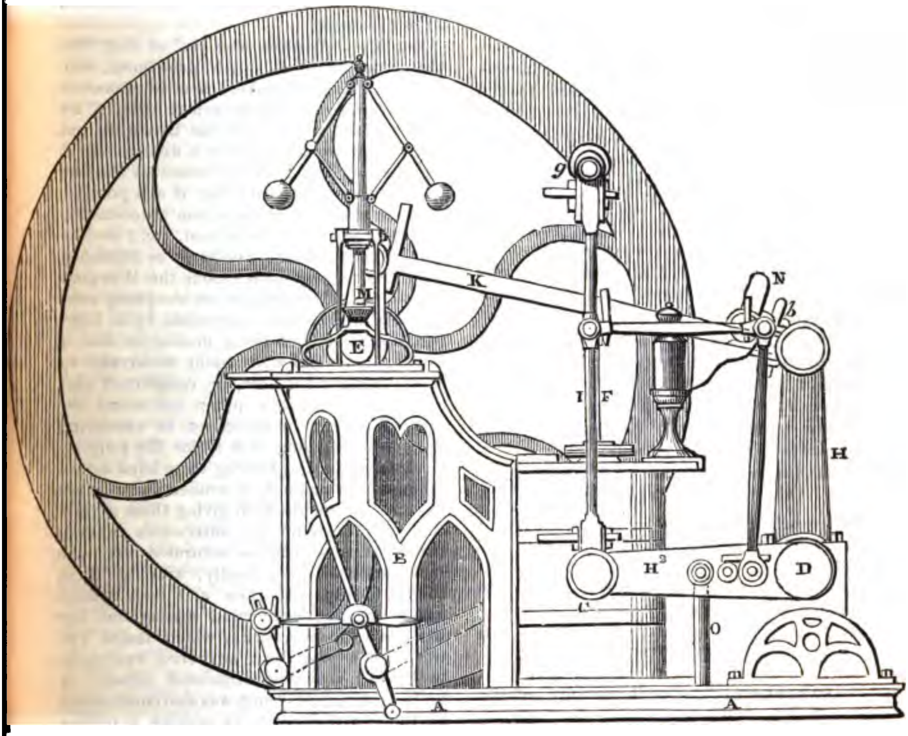
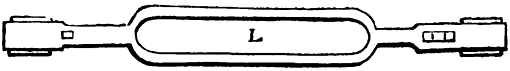


Fig. 2.



RIGHT-ANGLE-BEAM STEAM-ENGINE. MR. THOMAS EDWARDS, OF THE ISLINGTON FOUNDRY, BIRMINGHAM, ENGINEER, PROPRIETOR.

[Registered under the Act for the Protection of Articles of Utility.]

The chief point of novelty in the present engine is the placing of the cylinder between the beam-shaft and the fly-wheel shaft, and the considerable saving of room—in height more particularly—which is thereby effected.

Figure 1 represents a side elevation of this engine. A A is the sole or bed plate; B the framing; C, the cylinder, which is placed between, and at an equal distance from the beam-shaft D and the fly-wheel shaft E; F is the piston-rod, and *g* a cross-head, to which it is attached. The working beam consists of two arms, H H^2 placed at right angles to one another; the vertical arm H is keyed to the beam-shaft D, and connected by the horizontal arm H^2, to the vertical side-rods I I, which are attached to the cross-head *g*, one at each end; so that each reciprocating movement of the piston and cross-head is communicated through the medium of the side-rods I I, to the working beam H H^2, and the shaft D; K is the rod which connects the beam-shaft D with the fly-wheel shaft, and M is the crank on the end of the latter.

To enable the piston-rod to work free of the connecting-rod, the latter has an eye, or slot, I, in the vertical part of it, through which the former passes, as shown in the separate view given of the connecting-rod in figure 2.

In like manner the rocking-shaft N, which connects the radius bars of the parallel motion is curved up, or arched at the centre, to allow the end of the auxiliary beam H, and the key *b* of the connecting-rod K, to pass under. O is a rod for working the air-pump.

CAPTAIN DICKINSON'S TEMPORARY DIVING-BELL.

[From Transactions of Society of Arts.]

Captain Dickinson attended the Committee of Mechanics on May 4th, 1842, and gave the following account of the circumstances which led to the invention of his temporary diving-bell.

On the 4th December, 1830, His Majesty's frigate *Thetis*, 46 guns, with a complement of 300 men, sailed from Rio de Janeiro on her voyage to England, having on board gold and silver bars, and other treasures of various descriptions, amounting in value to about 810,000 dollars, the whole being shipped on account of merchants and others in England.

At eight o'clock on the following evening the ship having got out of her reckoning, ran on the precipitous rocks of the coast of Cape Frio, and was totally wrecked, with the loss of twenty-eight of the crew. The ship, after striking, drifted into a cove of about 100 fathoms inwards from the sea, and 90 fathoms broad, and surrounded by rugged and almost perpendicular cliffs, varying from 80 to 194 feet in height, where she sank with all her treasure.

Captain Dickinson, who had at that time the command of H. M. S. *Lightning*, submitted to Admiral Baker, then commander-in-chief of the South American station, his plan for the recovery of the treasure; but not being able to procure a diving-bell at Rio de Janeiro, nor the means of casting one, it occurred to him that it was possible to make such a machine of iron water-tanks, strengthened with bars of iron, &c.; and he obtained the Admiral's order to be furnished with two two-ton tanks from the *Warspite* (flag-ship). He next had an air-pump constructed under his own directions by an English mechanic, but being unable to find a workman at Rio who would undertake to make an air-tight hose, he recollected that there was Truscott's pump on board the *Lightning*, and he succeeded in rendering the hoses belonging to it fit for the purpose of the air-pump by beating them hard with a broad-faced hammer, to render the texture as close as possible, then giving them a good coat of Stockholm tar, afterwards binding them with new canvass saturated with the same material, and, finally, winding them round tightly with new and well-twisted yarns. These were used throughout the whole of the operations, which lasted upwards of a year, and answered extremely well, only requiring occasional repair. A more powerful air-pump was also constructed by Captain Dickinson, by making a trifling alteration in the force-pump of Fisher's watering apparatus, which he obtained from on board the *Warspite*, by application to the Admiral.

The first diving-bell used in the operations was constructed in the following manner:—One side of a two-ton tank (4 feet square) was taken out, another was divided into halves, from one of which halves the side was also taken out, and it was then securely

joined to the bottom of the former by riveting and caulking, thus forming a cubical vessel, 6 feet in height, by 4 feet in breadth each way, and open at the bottom. Round the upper square of the head, bars of iron, 2 inches broad and a quarter of an inch thick, were riveted, and others were placed down each side of the corners, from the head to the lower edge, which was also strengthened in the same way as the head. In the inside, at the upper corners, were diagonal bars to afford additional support against the pressure of water when the bell was suspended. Slings, made of the *Lightning's* top-chain, with shackles, were attached at each corner of the head, and the other extremities were united at the point of suspension by a chain cable shackle. For the purpose of weighting the bell, three loops of bar-iron were placed on each side of the lower half, through which a sufficient quantity of chain-cable was rove, with the addition of four large pigs of ballast, one fixed in each corner, in the inside, to sink it. At 18 inches from the lower edge in the inside, were two bars of iron, to answer the double purpose of strengthening the bell, and supporting two seats for the men to sit on; and across the centre of the bottom at the extreme lower edge, was a flat bar of iron to rest their feet on, which was removable at pleasure, to be put out of the way when the bell was at the bottom, so as not to obstruct their work. On the upper part, in the inside, were numerous hooks, for the purpose of suspending the various implements for boring rocks, digging, &c. It was lighted by six patent illuminators, two on the top, and one on each side. When weighted, it weighed about four tons, but it was afterwards made considerably lighter.

This bell was worked from a davit or crane fixed in the stern of a launch, which was a service of great labour and danger, the violent surging of the boat with the top weight of the bell on the davit frequently endangering its being swamped; and, in order to remedy this danger, Captain Dickinson greatly improved the bells subsequently constructed, by loading them with pigs of ballast only, placed within an iron frame, and merely wedged in, so that, in the event of the wind suddenly changing, they could be easily removed, and the bell be rendered so light that it could be shifted in a few minutes, by a small tackle, from the davit to the centre of the launch, the top weight being thus relieved, and the ballast available for the boat.

While the bell was worked in this manner, the advantage of the wrought-iron material was made manifest, the bell frequently oscillating to the extent of 10 or 12 feet, and it is more than probable that, under the same circumstances, a cast-iron bell would have been split, and the lives of the men lost.

In consequence of the labour and danger of towing the launch, at the close of each day's work, nearly a mile along the coast, and through a narrow strait, subject to violent currents into the still water of a bay, on the beach of which the crew of the *Lightning* were encamped, Captain Dickinson devised the construction of a derrick, of 158 feet in length, made up of twenty-two separate pieces of spars recovered from the wreck of the *Thetis*. The derrick was stepped in an excavation in the rock within the cove, a few feet above the water's edge, and supported at its head by a cable made fast to the rocks above, at the height of 150 feet, with various other stays, whereby the outer end of the derrick was raised to the height of about 40 feet above the sea. The summit of the cliff was levelled, and holes were worked in the granite wherein capstans and crabs were fixed; the crabs having been formed out of the stumps of the topmasts saved from the wreck. A stage was suspended from the derrick, from which a diving-bell larger than the others, but of a similar construction, was successfully worked. By all the contrivances, in which Captain Dickinson displayed consummate professional skill and ingenuity, turning all his disposable materials to account, and meeting each difficulty as it arose, no less than $\frac{1}{1}\frac{5}{8}$ths of the treasure, and a large quantity of government stores, were recovered.

The whole account of the operations forms a most interesting narrative of patient endurance, of fatigue, sickness and hardship under difficulties so extraordinary, that they would have been deemed insuperable by any but British sailors under the direction of a most intelligent and enterprising commander.

[The Society awarded to Captain Dickinson their Gold Isis Medal.]

THE CASE IN LEVERAGE.

Sir,—"H. H." now admits, (p. 454, vol. xxxix.) that the explanation I offered of the phenomenon (not anomaly) of equilibrium taking place in the case of a balance where the scales are loaded with unequal weights, is "perfectly correct," although he formerly designated that explanation as an "imagined" one. So far, therefore, I am satisfied. But there are one or two points in his last communication, to which attention may be advantageously directed.

1. "H. H." complains that in my communication (p. 325) I "occupied unnecessarily much space in showing the probability

of the coincidence of the centres of gravity, and suspension of a pulley." It is long since the observation was made, that it is much easier to give currency to error than to counteract it. "H. H." asserted that the centres in question could not possibly coincide. The shortest way of meeting such a ridiculous assertion would doubtless have been to contradict it, and to re-assert, as I had before done by implication, that two centres could coincide. But this would have been a less satisfactory way of meeting "H. H.'s" assertion than the way I adopted, which was to prove that two centres could coincide. And I also took occasion to show that the probability of what, for all practical purposes, may be regarded as coincidence, was very great indeed. In doing this I occupied, I think, no unreasonable space. But there is no pleasing some people; "H. H.," I dare say, would have preferred that I had left that point alone.

2. But "H. H." now says that his assertion, that the coincidence in question "could not actually exist," was only a supposition, made for the purpose of rendering his explanation general. Never before, I will take upon me to say, was a supposition made in such terms. Why he tells us in so many words that we are tied up to it, inasmuch as a different state of things "cannot actually exist"!

3. "H. H." says I should not be so anxious to claim as mine the explanation I offered of the phenomenon to which reference has been made, since it is to be found in Biot, and in Lardner's "Mechanics." Now on this I remark, first, that it is bad logic. The conclusion is wholly unwarranted by the premises. If I claim the merit of a discovery, my claim will not be invalidated by showing that others have made the same discovery. By a reference to dates the question of priority may be determined; but this will go only a small way towards the determination of the question of originality. But, secondly, not only is "H. H.'s" conclusion fallacious; his premises are also unsound. I made no claim to originality in the matter. You, Mr. Editor, allowed Mr. Phillips to state his difficulty for the consideration of your readers, and I offered what seemed to me a satisfactory explanation of it, in which I showed that the phenomenon to which Mr. P. referred was a very obvious result of well-known principles.* To have laid claim to original discovery in such a case would have been supremely ridiculous, and akin to claiming the origination of the whole theory of statics; and I said nothing on the subject which any one less ingenious than "H. H." could, I think, have by possibility twisted into the assertion of such a claim.

"H. H." appears to have grounded his ridiculous charge on the fact, which I admit, that I called the explanation I offered, *my* explanation. I called it so to avoid circumlocution, just as "H. H.," at p. 454, calls the explanation he offered, *his* explanation. Then, I ask, are we to infer that "H. H." claims for himself the honour of being the sole and original discoverer of the notable fact, that if two weights be suspended by a cord over a pulley, and the pulley be made to revolve, for each revolution of the pulley, the portion of the cord on one side will receive an accession equal in length to the circumference of the pulley, and that on the other side an equal diminution? To this "H. H." ought to answer, "Certainly." Very well—I am not one of the few who will be disposed to contest his claim.

In conclusion, had "H. H." been more cautious in his choice of terms, he had not been reduced to the necessity of now admitting that an explanation which he characterized as an imagined one, is "perfectly correct;" or of entreating us to outrage our understandings by believing that what seems to us a downright and unqualified assertion, is nothing more than a mere supposition. Nor would he have blamed me for the employment of a form of speech, in which, without showing wherein his privilege consists, he freely indulges himself. The practical inference he ought to draw, therefore, is, to be a very great deal more cautious in time to come, than he has been in time past.

I am, Sir, yours respectfully,

G.

Hermes-street, Pentonville,
January 23, 1844.

* I mean the principles of equilibrium, of which, by the way, "H. H." shows himself grossly ignorant, by supposing it possible (p. 275) that in the case of a body freely suspended, and at rest, the centre of gravity can be found anywhere but in the line passing through the point of suspension, and the centre of the earth.

PNEUMATIC COFFEE-POTS.

Sir,—Platow's Pneumatic Coffee-pot and Urn are justly held in estimation for the satisfactory manner in which coffee is made by them; but it is not to be denied that the former (Coffee-pot) is not so handy or convenient for ordinary use as could be wished. The moveable vase to be screwed on to the pot for the making of the coffee, and then to be screwed off for the pouring out the liquid by the same aperture, is not a very convenient arrangement, to say nothing of the awkwardness of making a screwed aperture

at the top of the pot to serve as a spout. To divest it of these objections I submit a form generally corresponding with that of the common Coffee-pot, with an internal arrangement as represented in the following engravings.

Fig. 1.

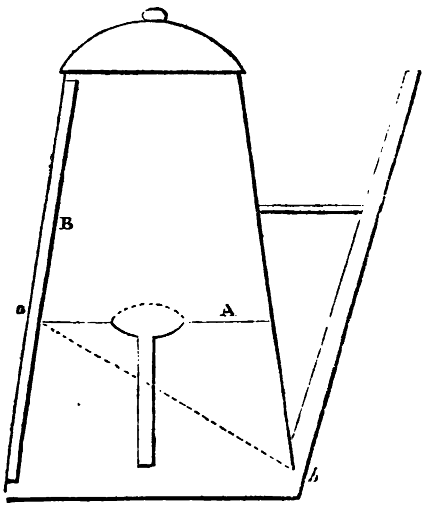
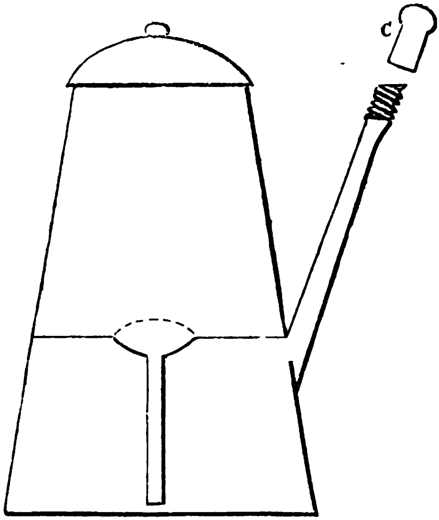


Fig. 2.



The Coffee-pot (fig. 1) is divided into two portions or compartments by a partition A, so placed, that the lower compartment shall be somewhat less than the upper, and capable of containing as much of the prepared fluid as may be wanted for use at a time. The centre of the partition is blocked into a well or dish, from the bottom of which an open tube descends to within an inch of the bottom of the pot. The well, or dished part, is covered by a wire gauze or perforated metal strainer of a convex form, as represented by the dotted curved line. The upper edge of the orifice communicating with the spout of the Coffee-pot, should not be more than half an inch from the bottom of the pot, *i. e.*, half an inch lower than the extremity of the tube before mentioned; and the spout itself should be as high as the top of the Coffee-pot. If now as much water be poured in as will fill the lower compartment, only so much of it will descend as will cover the extremity of the tube, the elasticity of the enclosed air preventing any more entering. This is practically of no consequence, as when the water is made to boil, steam is formed, the pressure of which causes the air to escape by the tube; and ultimately a vacuum is formed, which, on the pot being removed from the fire, becomes filled with the prepared fluid, being acted on by the pressure of the atmosphere. But a greater quantity of water, if desired, might in the first instance be made to enter the lower compartment, simply by inclining the Coffee-pot with the spout upwards, so as to make the dotted line *a b*, represent the level which the water would assume: the angular space above *a b*, would then represent the only portion occupied by air previous to the boiling of the water. It might be supposed that in the process of boiling, the fluid would be liable to be jerked out at the spout; but this would not be found to happen if it were conducted with ordinary moderation, and the ebullition prevented from being sudden and violent. The coffee grounds may be liable to settle on the strainer in a dense film, so as to intercept the pressure of the atmosphere and prevent the coffee flowing freely from the spout in pouring it out. The application of a spoon would at once remove the obstruction, but r this might be considered troublesome,

may be obviated by having an open tube B, on the side of the Coffee-pot opposite the spout, descending from the top of the pot to within half an inch of the bottom, by which a free communication with the atmosphere will be secured for pouring out the coffee without interfering with the specific action of the Coffee-pot in preparing it.

Figure 2 is another form corresponding with that in common use, which may perhaps be preferred by some to the preceding one. The only difference is, that the tube below the strainer may be carried to within half or quarter of an inch of the bottom, and the spout proceeds from an orifice at the top of the lower compartment. At the mouth it has a collar soldered on, with a screw cut on it, and a cap C screws on to the collar, and renders the spout air and steam-tight during the making of the coffee, and is afterwards removed for pouring it out.

I am, Sir, &c.

N. N. L.

January, 1844.

IMPROVED PILE-SHOE. MR. JOSEPH ALFRED CLARK, OF TEMPLE-LANE, WHITEFRIARS, PROPRIETOR.

[Registered under the Act for the Protection of Articles of Utility.]

Fig. 1. Fig. 3.

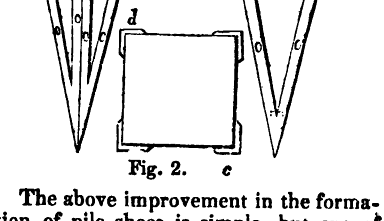


Fig. 2.

The above improvement in the formation of pile-shoes is simple, but one of such obvious utility, that it can hardly fail to be universally adopted.

Figure 1 is a side view of this improved shoe applied to a square pile regularly tapered to a point at its lower extremity. Fig. 2 is a plan of it, through the line *a b*, and fig. 3 a diagonal view on the line *c d* of fig. 2. It consists, it will be observed, of four pieces of angle iron, which embrace and protect the four *corners* of the pile (where, of course, the greatest liability to tear and wear is) and are welded together at their extremities. With the common shoe it is the *sides*, and not the *corners* of the pile which are protected.

When the pile is made with what is called a chisel point, that point is protected by a piece of angle iron in the same manner as the side corners; such additional pieces being also welded to the other angle pieces.

EEL-SKIN BANDS AND ROPES.

The new sort of bands described in the following communication to the Society of Arts from Mr. Joseph Williams,* seems eminently deserving the attention of our mechanical readers. The Society have awarded to the inventor their Silver Isis Medal.

Sir,—The enclosed is a specimen of eel-skin rope, which, for its little wear, far exceeds all others. I have used eel-skin upwards of twenty years for drilling holes for pearls and diamonds, by which means I have a knowledge of its utility. I have tried whipcord, which will not last an hour; I have tried also catgut, and that indeed is very little better. An eel-skin cut in three or four pieces of the same size as the gut or string will last for three or four months certain, which shows the little wear to which it is subject. I have had them on the shelf for from six to twelve months, in the dusty shop, till they have been quite hard, yet they are as good as ever. When first I thought of weaving eel-skins it appeared to me that it would answer for the Blackwall Railroad, as their rope was always wearing out; and had I the means I should have made a long piece, for it may be made of any length by splicing the skins. I am convinced it would answer their purpose, as it wears so little, and would, I think, last for months with but few repairs. My business is that of a goldsmith and jeweller.

I am, Sir, &c. &c.

JOSEPH WILLIAMS.

To the Secretary of the Society of Arts.

* 3, Coleman's Buildings, St. Luke's.

RECOGNITION BY LLOYD'S OF IRON SHIPPING.

We are glad to observe, from a Notice which appears in the newspapers, that the Committee for Managing the affairs of Lloyd's Register of Shipping, have decided that the time is come, for the admission of iron vessels to all the privileges of registration. The following are the principal passages of the notice :—

"The character of A 1 will in future be granted to such ships as shall be constructed of iron under the survey of the surveyors to this Society, and be reported, on their completion, to have been built of good and substantial materials, and with good workmanship.

"Iron ships already built, upon being subject to a careful and minute survey, and being reported to be in a high state of repair and efficiency, will also be classed as above; but, if not so reported, they will be allowed such other character as, on a due consideration of their respective claims, they may be found to deserve.

"In every instance in which a character may be assigned to ships built of iron, it must be understood that such ships must be subjected to a careful annual survey, and that the continuance or otherwise of the character assigned will depend entirely upon the result of this survey. Vessels not surveyed annually will lose their character."

DOUBLE STORIED BOILERS.

Sir,—Observing the remarks of M. J. E. in your last Number, impugning the statement in the description of the *Firebrand* steamer, that Mr. J. Seaward was the first inventor of the particular arrangement of tubular boiler therein shortly described, and known as "Seaward's boiler,"—I have made enquiries, and find that it is perfectly correct. It appears that it had been a favourite idea with Mr. J. Seaward for several years, but that he found some difficulty in inducing others to think as favourably of the plan as he did himself; nor was it until 1839, that he obtained an opportunity of making a boiler on his system, which was put into the Gravesend steamer *Topaz*, of 70 horse-power, where it has continued to work ever since, giving great satisfaction. The drawing which your correspondent has sent, bears some resemblance to the boiler of the *Topaz*, excepting that in the latter the tubes are much smaller, and the general form of the boiler is more rounded and compact. Since that time, I believe, the numerous applications of these boilers to large vessels by the firm of which he is a member, is pretty generally known, and other manufacturers are now fast adopting them in similar cases. In fact, it is rumoured that the eminent firm, who manufactured the machinery of the Royal Yacht, are about to take out the boilers of the old plan which were put in last year, and substitute others on the new one—a striking proof this of the high reputation this sort of boiler has earned for itself with the Government authorities.

My only object in making these remarks is to justify the statement commented on; and as, I believe, the correctness of the above observations will be nearly universally known and acknowledged by the most eminent engineers, I am not disposed to enter into any further discussion on the subject, as I think such a proceeding would serve no useful purpose, and would prove exceedingly distasteful to both the gentlemen whose names have been introduced in these communications.

I am, Sir, your obedient servant,

R. W.

IMPROVED MODE OF CASTING SQUARE-THREADED SCREWS.

[From last Volume of Trans. of the Society of Arts.]

The difficulty of casting square-threaded screws by the ordinary method is owing to the nature of the spiral curve of the thread, which, presenting its angle of inclination parallel with the axis in opposite directions on each side thereof, prevents the possibility of removing the pattern without displacing some of the sand. To remedy this defect, Mr. W. Bowser* has contrived a plan by which the patterns of square-threaded screws may be withdrawn from the sand and still leave perfect impressions for casting.

Instead of using only two flasks in casting any particular pattern, Mr. Bowser forms the mould for the screw in three flasks, two of which contain the upper and lower halves of the mould for the body of the screw, and the third one that for the mould of the head.

A metal plate of size sufficient to cover the end of the two long flasks when placed together, is attached to them, and has in its centre a screw-nut which holds the pattern screw in its right position in the sand, at the division of the two halves, to form the required mould.

When the pattern of the body of the screw is to be removed from the sand, a key is introduced into the end of the pattern which passes through the nut, by turning which

* 4, Swan-street, Minories.

key the pattern is screwed out of the mould; the nut, which is firmly secured to the plate, affording the necessary resistance.

The plate and nut are then removed, and the third flask, containing that portion of the mould in which the head of the screw is to be cast, is joined to the two long flasks, when the whole is ready for casting.

Fig. 1.

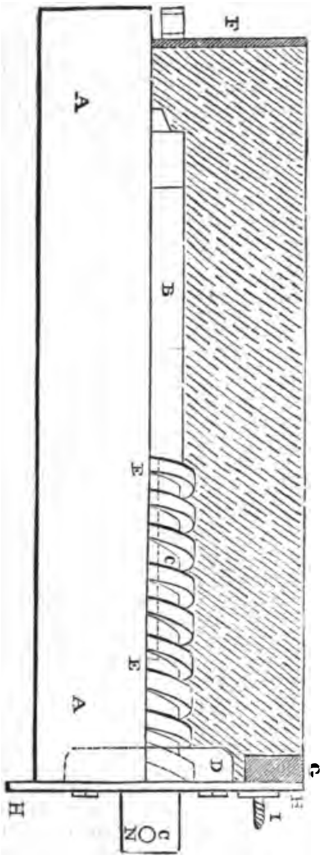
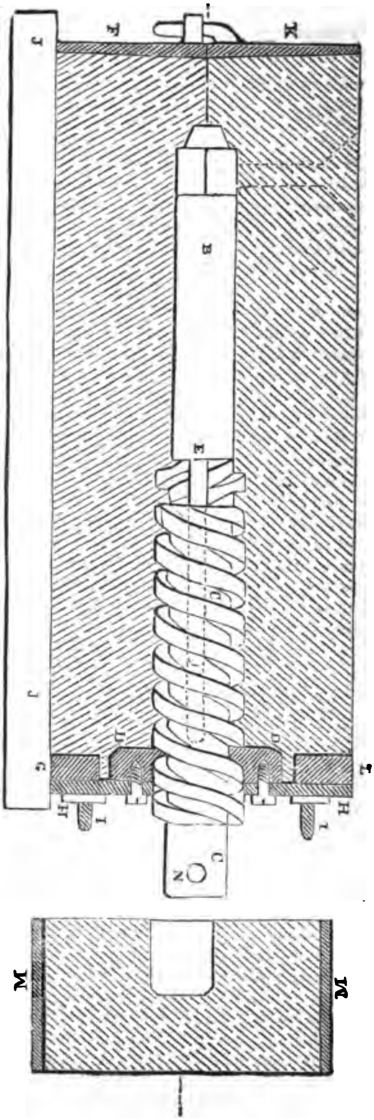


Fig. 2.



Figs. 1 and 2 exhibit sections of the flasks and screw in the different stages of the process.

A A, (fig. 1,) is a board prepared to receive half of the pattern screw, by having a hollow formed in it, so that the remaining half pro-

jects above the top of the board; B, C C, and D, are the three portions of the pattern.

The portion B is furnished with a pin E E, which passes into a cylindrical hole in the screw portion C, and serves to guide the pattern when being screwed out of the sand.

The part D has a hole properly cut to allow of a passage for the pattern to be removed. F G is part of one of the long flasks shown in section, and placed on the board A A. In the end G is a semi-circular aperture sufficiently large to allow of the sand being pressed in round the collar D. A metal plate H H is then screwed to the pattern collar D and to the flask F G by two screws I I. Sand is next filled into the flask and rammed solid to the top, as shown by the dotted sloping lines.

A second board J J (fig. 2,) is now fixed to the top of the flask F G, and the whole being turned over, the board J J becomes the lowest. The first board A A, is then removed, which leaves half the pattern above the sand. The first half of the mould is then made good if any defects are found in it; and the flask K L is then placed over and secured to the flask F and also to the plate H H. Sand is then filled into the top of this flask, and rammed solid as before, which completes the impression of the body of the screw. The plate H is next removed in order to attach to the two long flasks, by means of the screws I I, the end flask M M, which is filled with sand to take the impression of the head. This done, the end flask M M is removed, and the plate H H is again secured to the flasks F G and K L, and also to the collar D.

The screw portion of the pattern is now withdrawn by applying a key to the aperture N, and turning the pattern round till it is removed entirely from the sand.

In order to remove the plain portion of the pattern B, the upper and lower flasks are separated from each other, and then all the flasks being once more united, a proper opening is made in the sand, and the metal poured in to obtain the required cast.

[The Society of Arts have awarded their Silver Medal to Mr. Bowser for his invention.]

NOAD'S LECTURES ON ELECTRICITY.*

The volume before us bears on the title page to be "a new and greatly enlarged edition" of a work previously published under the same title. It is described, however, in a Preface by the author, as being essentially "a new work, bearing but little resemblance" to the former; and to us, at least, it is altogether so, for we do not happen to have ever met with the earlier edition. The "new work," of which alone we have therefore to speak, comprehends, under the general title of "Lectures on Electricity," every branch of science which has arisen out of, and is more or less identified with, electrical phenomena—as galvanism, magnetism, electro-magnetism, magneto-electricity, thermo-electricity, &c. The aim of the author has been to give a succinct and popular exposition of all the leading facts on these subjects known at the date of his publication; and in this he has, in our judgment, been eminently successful. We know of no other volume to which an enquirer can refer for the best and latest information on any of the topics indicated by the above titles, with so much certainty of finding it. The author is no mere compiler, but one who manifestly knows the things he treats of thoroughly, and can distinguish between what is essential and suggestive, and what is but incidental or insignificant. Mr. Noad, too, is himself a practical electrician, and has enriched his Lectures with a good deal of original matter derived from his own observations and experiments. So much as is his own, however, he introduces always with modesty; and whatever belongs to others he makes as invariably a point of acknowledging. Nothing, indeed, in the whole volume is more commendable than the spirit of candour and fairness which pervades it. Mr. Noad has never a harsh word to say of any body; but many a kind and encouraging one of persons whose own conduct has given them but small claim to gentle consideration.

The work is very appropriately dedicated to that distinguished cultivator of electrical science, Mr. Crosse, of Broomfield, of whose remarkable labours Mr. Noad gives the following interesting account:—

Of all the individuals in this country who have distinguished themselves by their researches in atmospheric Electricity, Mr. Crosse, of Broomfield, near Taunton, stands foremost. This gentleman, who, from a modesty which is inseparable from true phi-

* Lectures on Electricity: comprising Magnetism, Electro-magnetism, Magneto and Thermo-electricity. By Henry M. Noad, Author of Lectures on Chemistry. A new and greatly enlarged edition. Illustrated by nearly 300 woodcuts. 458 pp. 8vo. George Knight and Sons.

losophy, has only within the last few years permitted himself to occupy a portion of public attention, has devoted more than thirty years of his life to a close investigation of the science of Electricity, and his experiments have been carried on, on a scale, and conducted with a degree of skill, which have astonished every one who has had the good fortune to witness them. With a liberality that is truly gratifying, Mr. Crosse has not only permitted me to make a minute inspection of the whole of his magnificent arrangements, but has favoured me with written details of some of his observations, which, with his permission, I gladly take the present opportunity of presenting to the public.

Mr. Crosse collects the electricity of the atmosphere by means of wires supported and insulated on poles fixed on some of the tallest of the magnificent trees which ornament his grounds. As far as the eye can reach, these poles may be seen, though at present, in consequence of some extensive damages which happened during a late violent storm, there are not more than 1600 feet of wire insulated. The wires are insulated on the poles by means of funnels made of copper, about four and a half inches in diameter, and eleven inches in length; into a cavity or socket of about 2 inches deep, formed at the closed end of each funnel, is firmly cemented a stout glass rod of sufficient length to reach to the open end of the funnel, where it is mounted, by means of strong cement, with a metallic cap and staple. The latter appendage receives the hook of a very strong wire, which passes through a circular plate of copper placed about four inches from the mouth of the funnel, and terminates in a hook to which one end of the exploring wire is fixed. The object of the metallic disc is to preclude the admission of snow, rain, &c., and thus to preserve the glass rod in a dry insulating condition. These funnels are easily raised to the tops of the poles by an arrangement of pulleys, and thus the wires can at pleasure be drawn up and taken down. Outside the window of the gallery of the electrical room is fixed firmly in the ground a stout pole, on the top of which a large insulated funnel is fixed, and this forms the termination of the exploring wire, the electricity being conveyed from it through the window by means of a stout wire to a large brass ball, from which again it is conveyed by a curved wire to a brass conductor insulated and fixed on a table, and bearing the appropriate words, "*Noli me tangere.*" On the same plane with the conductor is fixed another arrangement having a metallic communication with a neighbouring pond, and by means of a screw the brass ball with which it is terminated may be adjusted at any required distance from the opposed brass ball of the conductor. By means of a lever furnished with an insulating handle, the current of electricity, when too strong, or when no experiments are in progress, is easily directed into the earth outside the window, and without entering the room.

The electrical battery employed by Mr. Crosse consists of fifty jars, containing 73 square feet of coated surface: to charge it requires 230 vigorous turns of the wheel of a 20-inch cylinder electrical machine: nevertheless, with about one-third of a mile of wire, Mr. Crosse has frequently collected sufficient electricity to charge and discharge this battery twenty times in a minute, accompanied by reports as loud as those of a cannon. The battery is charged through the medium of a large brass ball, suspended from the ceiling immediately over it, and connected, by means of a long wire, with the conductor in the gallery; this ball is raised from, and let down to the battery by means of a long silk cord, passing over a pulley in the ceiling: and thus this extraordinary electrician, while sitting calmly at his study table, views with philosophic satisfaction the wonderful powers of this fearful agent, over which he possesses entire control, directing it at his will; and, with a simple motion of his hand, banishing it instantaneously from his presence.

* * * * * *

The following interesting account of some brilliant electrical phenomena observed some years since by Mr. Crosse, during a dense November fog, has been kindly furnished me by that gentleman. "Many years since, I was sitting in my electrical room, on a dark November day, during a very dense driving fog and rain which had prevailed for many hours, sweeping over the earth, impelled by a south-west wind. The mercury in the barometer was low, and the thermometer indicated a low temperature. I had at this time 1,600 feet of wire insulated, which, crossing two small valleys, brought the electric fluid into my room. There were four insulators, and each of them was streaming with wet, from the effects of the driving fog. From about eight o'clock in the morning until four in the afternoon, not the least appearance of electricity was visible at the atmospheric conductor, even by the most careful application of the condenser and multiplier; indeed, so effectually did the exploring wire conduct away the electricity which was communicated to it, that when it was connected by means of a copper wire with the prime conductor of my 18-inch cylinder in high

action, and a gold leaf electrometer placed in contact with the connecting wire, not the slightest effect was produced upon the gold leaves. Having given up the trial of further experiments upon it, I took a book, and occupied myself with reading, leaving by chance the receiving ball at upwards of an inch distance from the ball in the atmospheric conductor. About four o'clock in the afternoon, whilst I was still reading, I suddenly heard a very strong explosion between the two balls, and shortly after many more took place, until they became one interrupted stream of explosions, which died away and re-commenced with the opposite electricity in equal violence. The stream of fire was too vivid to look at for any length of time, and the effect was most splendid, and continued without intermission, save that occasioned by the interchange of electricities, *for upwards of five hours*, and then ceased totally. During the whole day, and a great part of the succeeding night, there was no material change in the barometer, thermometer, hygrometer, or wind; nor did the driving fog and rain alter in its violence. The wind was not high, but blew steadily from the S. W. Had it not been for my exploring wire, I should not have had the least idea of such an electrical accumulation in the atmosphere: the least contact with the conductor would have *occasioned instant death*,—the stream of fluid far exceeding any thing I ever witnessed, except during a thunderstorm. *Had the insulators been dry, what would have been the effect?* In every acre of fog there was enough of accumulated electricity to have destroyed every animal within that acre. How can this be accounted for? How much have we to learn before we can boast of understanding this intricate science!"

Farther on, Mr. Noad describes Mr. Crosse's extraordinary success in the formation, by voltaic agency, of artificial quartz, arragonite, &c.:—

This gentleman has for many years been engaged with experiments on the conversion and production of mineral substances, and has succeeded in forming quartz, arragonite, malachite, and a great variety of most interesting minerals, by the slow and long continued action of the voltaic battery, charged with pure water only. It was not, however, till the meeting of the British Association at Bristol, in 1836, that the results of his experiments were first announced to the public by Mr. Crosse; and it is probable that his modesty would have prevented him from coming forward then, had he not been urged by the scientific enthusiasm of Dr. Buckland, who introduced him to the Geological section as "a philosopher who had made great discoveries by the use of a brick with a hole in it, immersed in a pail of water."

When the author had the pleasure of visiting Broomfield in the summer of the year 1842, the following experiments were in progress:—

1°. In an oval glass dish, of the capacity of about two quarts, was placed on the bottom horizontally, a flat piece of clay-slate, a few inches square, with a platinum wire round its middle, and connected with the negative pole of a *sulphate of copper battery*, of eight pairs of plates. Upon this was placed a piece of mountain limestone, of a few ounces weight, round the middle of which passed a platinum wire, connecting it with the positive pole. This stone was prevented from touching the slate below by three small wedges of deal, placed as supports. The glass dish was filled with spring water, and a stream of gas was rising from each wire. After two months' action, the negative platinum wire was entirely covered throughout its whole length, under water, with *crystalline carbonate of lime*, and the positive wire had produced a great effect upon that part of the limestone with which it was in contact, having *eaten into* it so as to form a neck round it. In another month the effects greatly increased, and carbonate of lime began to form rapidly over the whole of the slate, as well as over the greater part of the inner surface of the glass basin. It so happened that the most elevated part of the limestone stood perpendicularly above a part of the negative wire, from which a constant stream of hydrogen gas, in minute bubbles, was playing against the little wall of limestone above it. Exactly where this line of bubbles exists, about half an inch in width, is a line of most beautiful translucent crystals of carbonate of lime upon the limestone, and occupying the whole surface of that part of it which is exposed to the current of hydrogen gas. The actual size of these crystals when the writer saw them, was about one-eighth of an inch in length; but as it was Mr. Crosse's intention not to interfere with the progress of the experiment for a considerable time, they have doubtless increased much in size and beauty.

2°. In a glass jar of spring water were placed two pieces of clay slate, and between them a piece of crystallized carbonate of strontia, connected with the positive pole of a sulphate of copper battery, of six pairs of plates, the lower slate being in connexion with the negative pole: both slates were thickly covered with pearly-white carbonate of strontia in a botryoidal formation: the glass was also partially covered with stalactitic carbonate of strontia. This experiment had been going on eight months.

3°. In a similar jar, carbonate of barytes was being positively electrified: the negative wire and a portion of the slate was covered with a beautiful mamillated formation of carbonate of barytes.

4°. In a similar jar, sulphate of barytes was being positively electrified: the slate was studded with brilliantly transparent crystals of sulphate of barytes.

5°. A piece of solid opaque white quartz, suspended in a glass basin, filled with solution of pure carbonate of potash, was kept positively electrified by a similar battery, a similar piece of quartz being in the same manner kept negative. Some small pieces of quartz were placed between the two: there was a considerable formation of minute crystals.

The story of the *acari* resulting from (we do not say *generated* by) Mr. Crosse's application of the same agency to certain solutions, which was so much talked about, two or three years ago, forms the subject of another curious paragraph:—

It was in the course of his experiments on electro-crystallization, that that extraordinary insect about which so much public curiosity has been expended, was first noticed by Mr. Crosse. In justice to this talented individual, who was most shamefully and absurdly assailed by some ignorant individuals, on account of this insect, and who underwent much calumny and misrepresentation in consequence of experiments, which, "in this nineteenth century, it seems a crime to have made," I shall give a detailed account of that experiment in which the "*acarus*" first made its appearance. The solution with which the basin was filled was made as follows:—A piece of black flint was reduced to powder, having been first exposed to a red heat, and quenched in water. Of this powder, two ounces were taken and fused with six ounces of carbonate of potash: the soluble glass formed, was dissolved in boiling water, diluted, and hydrochloric acid added to supersaturation, the object being to form, if possible, crystals of silica at one of the poles of the battery. On the fourteenth day from the commencement of the experiment, Mr. Crosse observed, through a lens, a few small whitish excrescences or nipples, projecting from about the middle of the electrified stone, and nearly under the dropping of the fluid above. On the eighteenth day these projections enlarged, and seven or eight filaments, each of them longer than the excrescence from which it grew, made their appearance on each of the nipples. On the twenty-second day, these appearances were more elevated and distinct; and on the twenty-sixth day, each figure assumed the form of a *perfect insect*, standing erect on a few bristles which formed its tail. Till this period, Mr. Crosse had no notion that these appearances were any other than an incipient mineral formation; but it was not until the twenty-eighth day when he plainly perceived these little creatures move their legs, that he felt any surprise. When an attempt was made to detach them from the stone, they immediately died; but in a few days they separated themselves, and moved about at pleasure. In the course of a few weeks, about a hundred of them made their appearance on the stone: at first, each of them fixed itself for a considerable time in one spot, appearing to feed by suction; but when a ray of light from the sun was directed upon it, it seemed disturbed, and removed itself to the shaded part of the stone. . . . . . Mr. Crosse adds, "*I have never ventured an opinion as to the cause of their birth*; and for a very good reason—I was unable to form one. The most simple solution of the problem which occurred to me was, that they arose from *ova* deposited by insects floating in the atmosphere, and that they might possibly be *hatched* by the electric action. I next imagined, as others have done, that they might have originated from the water, and consequently made a close examination of several hundred vessels filled with the same water as that which held in solution the silicate of potassa. In none of these vessels could I perceive the trace of an insect of that description. I likewise closely examined the crevices and most dusty parts of the room with no better success."

In subsequent experiments, this same insect (which it appears is of the genus *acarus*, but of a species not hitherto observed) made its appearance in electrified solutions of *nitrate and sulphate of copper, of sulphates of iron, and sulphate of zink*; also on the wires attached to the poles of a battery working in a concentrated solution of silicate of potassa, also in *fluo-silicic acid.*

The fact of the appearance of *acari* under such circumstances has been since amply confirmed by the experiments of our old and esteemed correspondent, Mr. Weekes, of Sandwich, which are also thus noticed by Mr. Noad:—

At the suggestion of Mr. Crosse, that indefatigable electrician, Mr. Weekes, of Sandwich, in Kent, repeated some of these experiments, by passing currents of electricity through vessels filled with solutions of silicate of potash under glass receivers inverted over mercury, the greatest possible care being taken to shut out extraneous mat-

ter; and in some cases previously filling the receivers with oxygen gas. The result has been, that after an uninterrupted action of upwards of a year *insects have made their appearance in every respect perfectly resembling those which occurred in the Broomfield experiments*, as the writer can testify, having had many opportunities of examining each through a powerful microscope. In some recent experiments of Mr. Weekes', the *acarus* has made its appearance in solution of ferrocyanuret of potassium.

Mr. Weekes is, perhaps, next to Mr. Crosse, the greatest dealer in thunder and lightning (can we better express the fact?) in the three kingdoms; and we gladly avail ourselves of Mr. Noad's aid to make our readers acquainted with the wonders which our friend is in the daily practice of enacting:—

Amongst those individuals in whom the splendid electrical achievements of Mr. Crosse have excited an ardent taste for atmospheric investigations, my friend Mr. Weekes, of Sandwich, must not be allowed to pass unnoticed. This gentleman, at considerable trouble and expense, has erected an exploring wire, about 365 yards horizontally over the town in which he resides, insulating it against the balls from which arise the vane-spindles of the two churches, and conducting the termination to an insulated arrangement in his laboratory. "The scenes enacted by this apparatus," to use my friend's own expressive words, "are occasionally distinguished by a magnificence and interest which nothing short of ocular demonstration can serve to portray; nor, perhaps, are the almost hourly varying phenomena of its minor indications less deserving attention from the inquisitive admirer of natural science. When the gathering storm-cloud, pregnant with infuriated lightnings, and momentarily gaining additional sublimity from reverberating peals of deafening thunder, lingers over the line of wire, and deluges the earth with rain, or batters its beautiful foliage with unrelenting showers of hail,—then, tremendous torrents of electric matter, assuming the form of dense sparks, and possessing most astonishing intensity, rush from the terminus of the instrument with loud cracking reports, resembling in general effect the well known running fire occasioned by the vehement discharge of a multiplicity of small fire-arms. Fluids are rapidly decomposed: metals are brilliantly deflagrated; and large extents of coated surface repeatedly charged and discharged in the space of a few seconds. When these phenomena occur incidental to the hours of darkness, the lightning flash is seen harmlessly to play in various zig-zag and fantastic shapes amidst the several contrivances by means of which its power is subdued; thus augmenting the sublimity of a scene, compared to the correct delineation of which, the efforts of language are but imbecility."

In treating of the new art of casting by electric deposition, Mr. Noad traces the first glimpses of the thing to Daniell and De la Rue; but that does not prevent him (as has been the case with Mr. Smee) from doing full justice to Spencer and Jacobi:—

We can hardly resist a feeling of surprise that the application of the *facts* discovered by Daniell and De la Rue did not occur to either of these gentlemen. They were, however, too intent on the battery itself, to attend to any collateral circumstances; and it was left for Jacobi, in Russia, and Spencer, in this country, to do so. The process of the former distinguished philosopher was called "Galvano-plastic:" that of Mr. Spencer, "Electrography." And though it is quite certain that the discovery was made by each, independent of the other, the priority must be given to Jacobi, who states in the preface of his "Galvanoplastik," that it was in the month of February, 1837, while prosecuting his galvanic investigations, that he discovered a striking phenomenon which presented itself in his experiments, and furnished him with perfectly novel views; and Mr. Spencer, in his pamphlet, informs us, that his first results were obtained in 1838.

The merits of the controversy—somewhat bitter—between Mr. Harris, Mr. Sturgeon, and others, about the lateral discharge, and the efficiency of Mr. Harris's lightning conductors, are placed with great impartiality before the reader. Mr. Noad sides ultimately with Mr. Harris.

The various attempts to obtain mechanical power from electro-magnetism are fully described, and the failure of all of them made sufficiently manifest; but the author thinks that it would be rash to infer therefrom that there is no prospect of that object being ever accomplished. In this we perfectly agree with him. From quite as small and unprosperous beginnings as have occurred in this case, have some of our greatest successes in practical science arisen. Witness the power-loom, witness gas-lighting, witness steam itself.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 5 AND 6 VIC. CAP. 65.

Date of Registration. 1843-4.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
Dec. 29	98	Henry Laxton	32, Bold-street, Liverpool	Graduated steam-weighing balance.
Jan. 1	99	Joseph Wragg	Redbourne	Plough.
2	100	Thomas Edwards	Islington Foundry, Birmingham	Right-angle-beam steam-engine.
4	101	Mark Freeman	Sutton Common, Surrey	Drill and instrument to be used in the place of the bow and band now employed.
,,	102	Eli Richards	95, New Park-street, Bow, London	Coal-basket (improved).
5	103	J. and S. Daniel	208, Mosley-street, Birmingham	Flush table fastener.
8	104	Richard Hoyle	Louth	The Neptune Chariot, or marine life-preserver.
10	105	Cruse Horne	Oxford	Steam-cooking apparatus.
12	106	Robert Burton	Bolton-le-Moors	Double tappet or eccentric for the Jacquard loom.
15	107	James Bickerton, jun	36, Stamford street, Blackfriars.	Elastic dress and opera hat.
18	108	Andrew Shanks	22, Friday-street, London	Ratchet drill (improved).
17	109	William Cowan	Glasgow	Drum for gas-meters (improved).
19	110	C. J. Redpath	Commercial-road, Limehouse	Portable safety furnace.
20	111	William Bouch	Sheldon Works, near Darlington	Spring for railway and other carriages (improved).
22	112	John L. Steinhaeuser	5, Symons Inn, Chancery-lane	The Albert vest.

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The Electrical Magazine. By Mr. C. V. Walker. No. 3. 2s. 6d.

The London Polytechnic Magazine. Edited by Thomas Stone, M.D. No. 1.

Weale's Quarterly Papers on Architecture, Part II., price 7s. 6d.

Weale's Quarterly Papers on Engineering, Part II., 7s 6d.

LIST OF ENGLISH PATENTS GRANTED BETWEEN 28TH OF DECEMBER AND 23RD OF JANUARY, 1843-4.

Richard Archibald Brooman, of the Patent Office, 166, Fleet-street, London, gent., for certain improvements in figure weaving machinery. (Being a communication.) December 28; six months.

Thomas Murray Gladstone, of Swan Garden Iron Works, Wolverhampton, iron-master, for certain improvements in machines for cutting or shearing iron or other metals, which improvements are applicable to other like purposes. December 28; six months.

George Benjamin Thorneycroft, of Wolverhampton, iron master, for a machine for rolling, squeezing, or compressing puddled balls of iron, and also for crushing or grinding other substances. December 28; six months.

Robert Noyes Elven, of Southampton-street, Camberwell, shoemaker, for improvements in the manufacture of boots, shoes, galoshes and clogs, which improvements are applicable to the manufacture of leather hose and buckets. December 28; six months.

Henry Lowcock, of Westerland, Devon, yeoman, for improvements in ploughs. December 28; six months.

Edward Budd, of Swansea, Glamorgan, copper merchant, and William Morgan of the same place, refiner of copper, for improvements in treating or reducing of copper ores, and in the construction of furnaces for treating such ores, part of which improvements are applicable to other ores. December 28; six months.

George Gwynne, of Regent-street, gent., and George Fergusson Wilson, of Belmont, Vauxhall, gent., for improvements in the manufacture of candles, and in treating fatty and oily matters, to obtain products for the manufacture of candles and other uses. December 28; six months.

James Champion, of Salford, Lancaster, machinist, and Thomas Marsden, of the same place, machine maker, for improvements in drawing and spinning cotton and other fibrous substances. December 28; six months.

Alexander Denoon, of Adams-court, Broad-street, London, merchant, for improvements in the mode of making carbonate of soda. January 1, 1844; six months.

Alexander Denoon, of Adams-court, Broad-street, London, merchant, for improvements in the mode of making muriate of ammonia. January 1; six months.

William Longmaid, of Plymouth, Devon, accountant, for an improvement in the manufacture of copper, tin, zink, and peroxide of iron. January 1; six months.

John Hinks, George Wells, and Joseph Finnemore, all of Birmingham, Warwick, metallic penmakers, for improvements in the manufacture of metallic pens, and in machines for manufacturing metallic pens. January 4; six months.

William Wright, of Duke-street, Saint James, Middlesex, surgeon, for certain improvements in rendering leather skins or hides impervious to wet, more flexible and more durable. January 11; six months.

Laurence Hill, jun., of Glasgow, civil engineer, for improvements in machinery for manufacturing shoes for horses and animals. (Being a communication.) January 11; six months.

William Hale, of Woolwich, Kent, engineer, for improvements in rockets. January 11; six months.

Robert Foulerton, of the Jamaica coffee-house, Cornhill, London, master mariner, for certain improved machinery for moving vessels, and other floating apparatus. January 13; six months.

Anthony Movillon de Ghines, of Panton-street, Haymarket, gentleman, for certain improvements in apparatus for propelling vessels on water, and also in machinery capable of communicating manual power to work the same, which machinery is also applicable to raising heavy bodies, and exerting power for various other purposes. January 13; six months.

Henry Bessemer, of Baxter House, St. Pancras, engineer, for a new pigment or paint, and the method of preparing the same, part of which method is also applicable to the preparing and treating of oils, turpentine, varnishes, and gold size, when employed to fix metallic powders, and metal leaf, or as a means of protecting the same. January 13; six months.

James Lindley, of Cranbourne-street, Middlesex, gentleman, for improvements in coffins. January 16; six months.

Thomas Aspinwall, of Bishopsgate Churchyard, esquire, for an improved cannon, formed either of wrought iron, or steel, or wrought iron and steel combined, and also instruments and machinery used in making, and method of making the said cannon. January 16; six months.

Charles Cameron, of Liverpool, chemist, for improvements in extinguishing fires in buildings. January 16; six months.

Benjamin Cheverton, of Pratt-street, Camden-town, sculptor in ivory, for improvements in machinery for cutting wood and other materials. January 16; six months.

William Edward Newton, of Chancery-lane, civil engineer, for improvements in machinery or apparatus for facilitating the tracing and copying of designs, drawings, and etchings of all kinds, either of the original size, or upon an enlarged or reduced scale. (Being a communication.) January 16; six months.

William Watson, jun., of Leeds, manufacturing chemist, for improvements in the manufacture of sulphate, muriate, and other salts of ammonia. January 16; six months.

William Nichol, of Edinburgh, printer, for improvements in lithographic, and other printing-presses. January 16; six months.

John Fielding Empson, of Birmingham, manufacturer, for certain improvements in the construction and manufacture of buttons, and other fastenings for dress. January 16; six months.

William Basford, of Burslem, Stafford, brick and tile manufacturer, for certain improvements in the mode of manufacturing bricks, tiles, quarries, and certain other articles made or composed of brick, earth, and of burning and firing the same, and certain articles of pottery and earthenware. January 23; six months.

Claude Francois Jules Petit, of Regent-street, merchant, for improvements in fastenings for gloves. (Being a communication) January 23; six months.

Samuel Wright, of Shelton, in the Staffordshire Potteries, for a manufacture of ornamental tiles, bricks, and quarries for floor pavements, and other purposes. (Being an extension of former letters patent, for the term of seven years, from the 26th instant.)

Thomas Nash, of Paul's Cray, Kent, paper ma-

nufacturer, for certain improvements in the machinery for the manufacture of paper. January 23; six months.

Henry Davies, of Norbury, Stafford, engineer, for certain improvements in the construction of vessels for conveying goods or passengers on water, also certain improved arrangements of machinery for communicating motion to such vessels. January 25; six months.

LIST OF PATENTS GRANTED FOR SCOTLAND FROM DECEMBER 22ND, 1843, TO THE 22ND OF JANUARY, 1844.

Henry Austin, of 27, Hatton-garden, Middlesex, civil engineer, for a new method of gluing or cementing certain materials for building and other purposes. Sealed, December 26.

Francis L'Estrange, of Dawson-street, Dublin, surgeon, for improvements in hernial trusses, to prevent the descent of hernia through the internal as well as the external ring. December 26.

Charlton James Wollaston, of Welling, Kent, gentleman, for improvements in machinery for cutting marble and stone. (Being a communication from abroad.) December 26.

George Gwynne, of Regent-street, Middlesex, gentleman, and George Fergusson Wilson, of Belmont, Vauxhall, Surrey, gentleman, for improvements in the manufacture of candles, and in apparatus for, and processes of treating fatty and oily matters to obtain products for the manufacture of candles, and other uses. December 29.

Margaret Henrietta Marshall, of Manchester, Lancaster, for a certain improved plastic composition, applicable to the fine arts, and to useful and ornamental purposes. January 5, 1844.

James Champion, of Salford, Lancaster, and Thomas Marsden, of Salford, Lancaster, machine-makers, for improvements in drawing, winding, and spinning cotton, and other fibrous substances. January 9.

James Overend, of Liverpool, Lancaster, gentleman, for improvements in printing fabrics with metallic matters, and in finishing silks and other fabrics. (Being a communication from abroad.) January 9.

Charles Townsend Christian, of St. Martin's-place, St. Martin's-lane, Middlesex, East India army agent, for improvements in the construction of steam-engines. (Being a communication from abroad.) January 12.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in machinery or apparatus for facilitating the tracing or copying of designs, drawings, and etchings of all kinds, either of the original size, or upon an enlarged or reduced scale. (Being a communication from abroad.) January 15.

William Nichol, lithographer and printer in Edinburgh, for improvements in lithographic and other printing presses January 18.

Charles Tayleur, and James Frederick Dupré, of the Vulcan Foundry, Warrington, Lancaster, and Henry Dubs, also of the Vulcan Foundry, engineer, for certain improvements in boilers. January 18.

Alexander Bain, of 320, Oxford-street, Middlesex, machinist, for certain improvements in producing and regulating electric currents, and improvements in electric time-pieces, and in electric printing, and signal telegraphs. January 19.

William Edward Newton, of Chancery-lane, Middlesex, civil engineer, for certain improvements in machinery for preparing and combing wool, hair, and other fibrous substances. (Being a communication from abroad.) Jaunary 19.

NOTES AND NOTICES.

Deposits in Steam Boilers.—A Paris paper states, that by accident, a mode has been discovered of preventing calcarious deposits being formed in the boilers of steam engines. A sawyer of mahogany in the Faubourg Saint Antoine, whose machinery is worked by steam, perceived, a short time since, on opening the boiler to have it cleaned, that there was no deposit whatever, but that some mahogany sawdust had by chance been introduced. He has since repeated the experiment, and found that in all cases the sawdust keeps the boiler clean.

Naphtha Lights.—The *Bristol Mirror* states that, "The Imperial and other fire offices have issued a notice to their agents that the naphtha or liquid gas lamps, recently introduced into manufactories and other premises, are attended with considerable hazard, and that in effecting all future insurances on such premises a warranty must be given that these lamps are not used therein: and that the agents are required to decline all insurances of premises lighted with them."

A new mode of Illuminating Clocks has been brought into operation by Mr. H. Hughes, of Liverpool, by which gas is conveyed into the spindle or shaft on which the hands are fixed, and thence to the hands themselves. A light burns in the centre, and is red in colour. Two lights revolve with the hands, one green and the other white. The two revolving lights are further distinguished from each other, by one being placed at double the distance from the centre.—*Liverpool Mercury.*

Substitute for Wood.—A singular substance has lately reached this country from Singapore, which promises to become of some importance as a material for the handles of knives, tools, and all instruments which require great strength. It is a pale, greyish, salmon-coloured material, rather stringy, softening at 150°, and then capable of being moulded into any form. It is hard, compact, and not very unlike horn in texture. We believe it has been found by Mr. Edward Solly to be analogous to India rubber in its chemical constitution. — *Gardeners' Chronicle.*

Royal Enlightenment.—In Major Harris's account of his embassy to Abyssinia (vol. ii. p. 30) we observe that it is stated that the king was instructed in the manner of exploding magazines with detonating shells, and also in the application to the same purpose of the air-gun. It is now over twenty years since Captain Norton first used his rifle percussion shells discharged from one of Standenmayer's rifle air-guns, as was duly recorded at the time, or soon after, in our pages. Thus it is, that useful inventions, often neglected, and even discouraged at home, are received with favour abroad. Captain Norton's invention having now penetrated into the heart of Africa, we may reasonably expect that it will shortly make the Grand Tour of the World.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1069.] SATURDAY, FEBRUARY 3, 1844. [Price 3*d*.

Edited by J. C. Robertson, No. 166, Fleet-street.

MR. MOAT'S IMPROVED MODE OF APPLYING HORSE POWER ON COMMON ROADS.

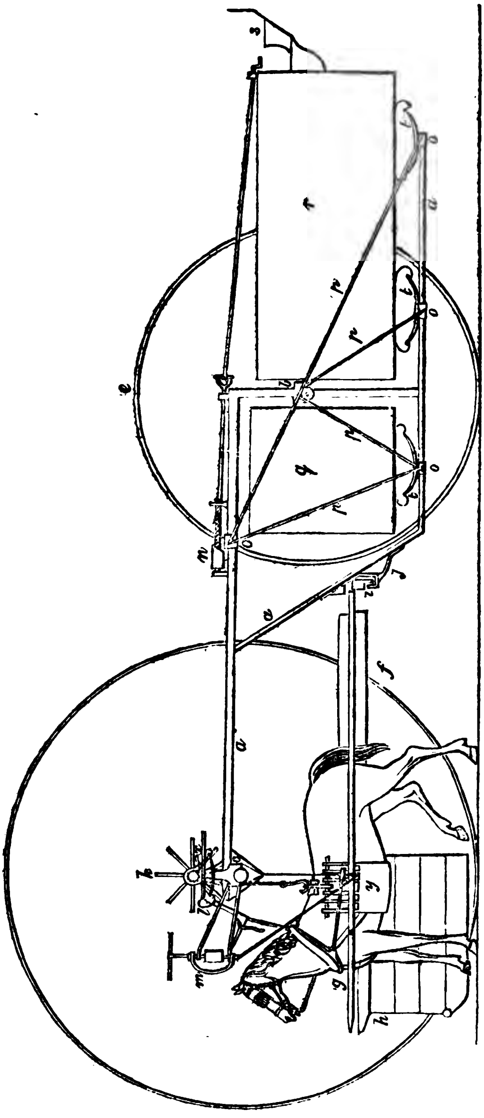


Fig. 1.

MR. MOAT'S IMPROVED MODE OF APPLYING HORSE POWER ON COMMON ROADS.

SIR,—In your Magazine of the 20th inst., there is a notice of a new application of horse power, stated to have been invented by a French mechanic. The horse is placed within a sort of treadwheel, and working after the manner of a squirrel, turns the wheel, which in its turn gives motion to the wheels of a railway carriage, carrying either goods or passengers. Without offering any opinion on the merits of this invention,* I should feel obliged if you would permit me to make known, through the pages of your universally read and esteemed journal, an invention of a countryman of our own, for the better application of horse power—not to railways, on which there is but small chance of its being ever again employed, but *to locomotives on common roads*, where the horse is still likely for many a day to "bear the bell." I allude to the invention of Mr. Wm. Crofton Moat, which was patented some four or five years ago; but has not as yet received that attention from the mechanical world, which, in my humble judgment, it deserves.

Mr. Moat introduces the subject in his specification by the following observations:—

"The nature of my invention is such, that by its application, passengers or goods may be forwarded by any given amount of power at a velocity greater than that hitherto attained by the same amount of power on ordinary roads, the manner of performing which is by the construction of a four-wheeled carriage of such form and dimensions as will allow of the said power being placed between the two front wheels thereof, that situation of the power giving the advantage of causing the direction of the applied force to agree with that of the resistance to forward motion, whether it be in curved or straight lines, and when animal power is used, of the supporting of so much of the animal frame as may not be useful as a propelling power, and so causing the body of the animal to have a steady progressive motion, instead of the rising and falling motion, necessarily belonging to unassisted terrestrial animal progression, whereby the animal becomes exhausted, much more by the unsteady carrying of its own body, than by the resistance of the inertia of the vehicle."

The apparatus by which Mr. Moat carries out these principles is represented in the accompanying figures, 1, 2, and 3; and is thus described by the inventor:—

"Fig. 1 shows the relative position of the various parts, and may be considered as a side view of a machine called by me 'an accelerator,' the two near side wheels, and same side 'shield' being removed, and a horse placed on the off-side, in the position it would occupy when harnessed, the near-side horse then being in a corresponding situation. The wheels are here shown without spokes for convenience of reference. *a, a, a, a, a*, is the frame; it is made of wood with iron fastenings. *b*, is the bed of the after axletree; it is made of wood, is firmly attached to, and supports the after part of the frame, and carriages thereto attached. *c*, the bed of the fore axletree; it is made of wood, is attached to the fore-part of the 'frame' by the perch bolt; it supports the driving box—the shafts, by means of two descending vertical planks, that is to say, one attached to each end—the pole, by means of an iron rod placed vertically under the perch bolt—the circle on which the end of the frame works when turning, and which is fixed by iron bars, giving also attachment to the iron rod last mentioned—the steering machine—and the apparatus by which the bearing belts may be tightened or otherwise; occasionally, therefore, also supporting a portion of the horse's weight. *d*, the periphery of the forewheel. *e*, the periphery of the hind wheel; the axletrees are seen in the centres. *f*, a shaft; it is a broad plank, supported from the bed of the fore axletree by a vertical plank; it supports a shield, and is attached behind to the sweep. *g*, the pole — a narrow plank hanging by an iron rod placed under the perch bolt; it supports a stay to the steering machine, and is attached behind to the sweep. *h*, a shield; it is composed of a series of planks, which, with the exception of the bottom one, are placed edgeways under each other, the uppermost one being the same way attached to the shaft; the lowermost one, which reaches to within a short distance of the ground, is swung by a pivot to the plank next above it in such a manner that, when meeting with any obstruction, it may rise, and pass up the outside of the shield; its use is to pre-

* If the reader will refer to our 12th Volume, p. 162, he will find that the French machine referred to is but a re-invention of the Cycloped of Mr. Brandreth, exhibited at the Liverpool Railway competition in 1829.—ED. M.M.

Fig. 2.

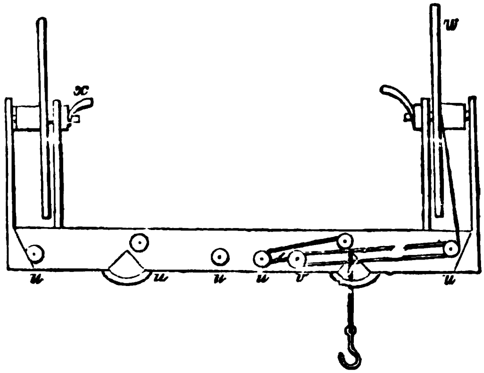


Fig. 3.

vent the horses' fore-feet from getting under the wheel when training, not otherwise necessary. *i*, the sweep; it connects the after ends of the shafts and the pole together, and has a projecting ridge of iron, which, fitting into a catch, causes it to take some of the strain from the perch bolt. *j*, the catch; it is made of iron, and receives the ridge of iron above mentioned; a piece of wood is so fixed above it as to prevent the sweep from jumping out of its place. *k*, the raising wheel, better seen in fig. 2, by which the driver can heighten or lower the bearing belts at pleasure, by turning the wheels, which act upon systems of ropes and pulleys. *l*, the driving seat; it is supported on springs over the circle and perch bolt by two upright pieces of wood morticed on to the top of the bed of the fore axletree. *m*, the steering machine; this is composed of a rope wound round a barrel of wood, having the same axis as a wheel placed at command (after the manner of the tiller rope of a ship), each end of which rope, after passing through pulleys, which are fixed on the top, and as near to the end as possible of the bed of the fore axletree, is finally fastened to a hook on one side of the frame; the wheel and barrel are kept in their proper position by five iron bars, two from each extremity of the bed of the fore axletree, and one from the pole. The principal use of the steering machine is that of obviating the effects of any inequality in the relative strength of the horses (not necessary with well trained horses). *n*, the drag, is a strong frame of wood, with an iron shoe at each end, moved by a fixed screw, the handle being placed conveniently for the guard. *o o o o*, four pieces of wood placed across and firmly fixed to the frame, the three lower ones supporting the coaches on springs. *p p p p p*, five thin bars of iron connecting the four pieces of wood and bed of the after axletree together. *q*, the front carriage; it has a door in front, and carries three passengers. *r*, the after carriage; it has a door behind. *s*, the guard's seat. *t t t*, coach springs. *u u u u u u*, fig. 2, shows the pulleys fixed to the front part of the fore axletree bed; those nearest the extremities being double. *v*, fig. 2, a moving double pulley, connected only by rope. *w*, fig. 2, a wheel situated by the side of the driver, which, when turned round, winds a rope on the barrel, and thus raises the bearing belt by means of the span. *x*, rack wheel and catch-pin—use obvious. *y*, the bearing belt is made of leather, having straps at the ends, by which it is buckled on to bars of wood, and a connecting strap to the collar. Z, fig. 3, an iron span, by which the two ends of the belt are connected over the horse's back."

Mr. Moat remarks that the "bearing belts" are only to be used when the machine has "gathered way;" for at other times they would be more likely to decrease than increase the effective power of the horses employed. When the horses have "gathered way," the more they are eased, and the steadier they are supported, the greater of course will be the velocity accomplished. Some horses might require broad martingales and breast straps to prevent the bearing belts from acting too much on the hinder parts of their bodies.

It is now well ascertained that a man can, with the aid of a velocipede, travel with ease, six and seven miles an hour, which is nearly twice as many as he can travel unassisted. Why, then, should not a horse, with similar mechanical

aid, be enabled also to increase its speed in the same ratio? And has anything better suited for the purpose than this "Accelerator" of Mr. Moat been yet invented?

A one-horse machine might be made on this principle, which would admit of a bent axletree being used for the fore-wheels, in which case they might be of the ordinary height, and would not take up more than the ordinary width of road.

I am, Sir,
Your constant reader,
S. P. B.

London, January 22, 1844.

ON THE VELOCITY OF JETS, AS AFFECTED BY RESISTING MEDIUMS.

Sir,—The phenomena exhibited by jets, whether of elastic or non-elastic fluids, are certainly very curious and interesting, and I am obliged to your correspondent Y. Z., for directing my attention to the experiments instituted by Mr. Fox Talbot on this subject, as related in the Transactions of the Royal Society; but I cannot agree with him that they are marked by anything in the slightest degree difficult to comprehend, or to reconcile with the acknowledged laws of mechanics. It is very true, as Venturi says, and whom your correspondent quotes, that "the same methods adopted by geometricians, which have afforded them such surprising advances in the mechanics of solids, do not afford any conclusions with regard to hydraulics;" and not one of your correspondents has enforced this and other truths of the kind, referable to practical operations, more on the attention of your readers, than myself. But it is one thing to be unable to trace the operations of nature, step by step, with mathematical certitude and exactness, embracing all the by-play and disturbance of their interfering actions, and arriving by necessity at calculable and unerring results; and quite another thing not to be able to recognise, in these complicated phenomena, the same general laws which have been educed from simpler cases; nor to possess the power of forming a conception, at least, of the true order and method of nature's proceedings. Incompetent as we may be to unravel all the mystery of her evolutions, we are not to suppose that they are entirely veiled from sight; and though the mathematician may be foiled, (and foiled he is, much oftener than he is disposed to admit,) we are not to conclude that the things which are intractable to him, are beyond the domain even of good common sense. Indeed, the light which the laws of nature shed on the most obscure subjects, belonging to that department of knowledge under consideration, is such, that practical sagacity is well able to divine the general course and nature of the operations which they regulate. With such views the practician is satisfied; he finds in them all he wants, all that is sufficient for his purpose; and he turns them to account, long before the mathematician is prepared, if ever, to array them in the symbols of his art. It may be very possible to understand phenomena, although it may be impossible to calculate them. The doubts and misgivings of Venturi refer only to the *mathematics* of hydraulics; and truly he, and all other mathematicians, have reason enough to be dissatisfied with their science in this respect; but, fortunately, the *physics* of the subject are, for all useful purposes, entirely within the grasp of good practical talent.

Your correspondent says, that "the difficulty of satisfactorily explaining the problem of the jet is increased, by the fact ascertained by the experiments made by Mr. Fox Talbot, that the jet of water was not impeded perceptibly, or any alteration in its velocity caused, by being put in action in various mediums. For instance, with a head of water of six feet, the vessel was emptied by means of a jet, in equal times, whether the orifice of the jet was immersed in water, in air, or even when immersed in mercury." Now this is an apt illustration of the confused and imperfect views which may be taken of the *physique* of a phenomenon, by persons very expert in mere calculation; and which, whilst it does not require a man to be a mathematician to avoid, a mathematician may as easily entertain as any one else; but as I have not the Transactions of the Royal Society to refer to, I cannot say on whom this confusion of ideas is chargeable.

The two things here confounded, are, the velocity of the jet as a stream, and the velocity of its issue from the orifice. It is only in respect to the latter parti-

cular, or to the initial velocity, that the emptying of the head of water in equal times, is a proof that "the jet of water was not impeded perceptibly, or any alteration in its velocity caused, by being put in action in various mediums." Now there is nothing at all "extraordinary" in this, if the different mediums into which the jet issued exercised no sensible hydrostatic pressure upon it; but if they were of such a height as to have an influence of this kind, we may be very well assured—barring a miracle in the case—that the velocity of the efflux *was* diminished, and that the head of water was *not* emptied in equal times. The veracity of the statement is not of course to be questioned, and therefore the inference necessarily is, that there was not a *column* of the fluid pressing upon the orifice of the jet; and it is such pressure, and not the density of the medium, that could be expected to impede the initial velocity. And now as to the retarding of the velocity of the jet as a stream—it would indeed be extraordinary, if that did not happen under the circumstances mentioned; but of course it did—barring another miracle—for the consumption of water being the same in equal times, has no bearing whatever on the point. So that what is to be truly understood as proved by these experiments, is not at all extraordinary; and what by a confused statement of them has the semblance of being extraordinary, is not true.

In your Magazine for July last, No. 1041, I gave a formula for determining the comparative velocities of jets of steam, under different pressures, but subject to atmospheric resistance, and on the assumption, that one velocity under a given pressure and subject to such resistance had been ascertained by actual experiment; for I more than mistrust the mathematical datum of the velocity of steam into a vacuum. As there was a slight error of the press, in describing the notation, I beg leave to repeat it.

$$v = V \times \frac{P}{P-p} \times \frac{P'-p}{P'}$$

"P is the steam pressure (against a vacuum) corresponding to the velocity V, as experimentally determined; P′ the like pressure, answering to the velocity v that is sought; and p the atmospheric pressure. As it is not the *resistance* of the air, but the *pressure* of the atmosphere that is included in this formula, it gives of course the *initial* velocity." The subsequent retardation of the velocity of the jet, by the density of the medium into which it flows, is in fact quite another question; but if the medium presses with a fluid column of any height above the orifice, then the pressure thus exerted, in addition to that of the atmosphere, will undoubtedly affect the initial velocity of the jet, as well as the retardation of it as a stream. All this is anticipated in the above formula, for p represents the minor, or counter-pressure, whether it arises from the atmospheric column singly, or conjointly with other columns of fluids; or whether it results from an elastic, or from a gravitating force. If p be made equal to P, no jet of course ensues. It is only as the density of the resisting medium contributes to the increase of p, that it exercises any influence on the efflux and the initial velocity of the jet; and of course it has no effect of this kind, unless there be a column of fluid above the orifice; and then, for a given height, the counteracting pressure will vary with the density.

If the jet possessed cohesion like a solid, the retarding forces, varying with the different densities of the resisting mediums, would of course act back to the very orifice, and produce corresponding variations in the efflux of the jet; but this does not take place, because of the mobility of fluids; and the only effect is the dispersion of the jet as a stream. Even if it were not a dense fluid but a solid, which opposed resistance to the jet, it would not affect the initial velocity, until it was advanced so close to the orifice, as to interfere with the free escape and dispersion of the particles of the fluid. What there is "extraordinary" in this, or in Mr. Fox Talbot's experiments, I cannot conceive; but surely your correspondent has mistaken the drift of those experiments, and of the observations that accompanied them, or they never would have found their way into the Transactions of the Royal Society. If so, he owes Mr. Talbot a candid and ample apology.

I am yours, &c.,

BENJAMIN CHEVERTON.

ON MAGNETIC THEORIES—BY G. V. TOWLER, ESQ.

[Continued from Vol. xxxix. p. 386.]

"That they are neutral and inert when combined, as in soft iron; but when they are decomposed, the particles of the austral fluid attract those of the boreal, and *vice versa*, whilst they repel each other."

That the particles of these fluids are neutral and inert, there can be no doubt, because all matter, be it known by this name or that, or be it in one form or other, is essentially inert, and possesses of itself no power of motion, but that neutrality and inertia are the effects of a combination, or that activity is the result of decomposition, is not quite so evident.

It is said "when they are decomposed." Now does this mean that they are decomposed by each other, or by any other agency? It would undoubtedly have been interesting if some idea had been given us of the supposed process. As it is, there is a difficulty which is not easily got rid of; for if these fluids naturally decompose each other, it may be asked, how is it they ever became combined? If they are decomposed by any other agent, we cannot help exclaiming, what a mysterious agent this must be! It must undoubtedly be some occult power, of which philosophy has never yet treated.

I am disposed to think that whether they decompose each other, or are decomposed by any other means, the mere act of decomposition would neither generate in, or invest matter with, abstract inherent properties, which it did not possess when in a state of combination. Decomposition, if any took place, would undoubtedly be the consequence of some force or other acting on the fluid or fluids, and might possibly, by different degrees of power in various combinations of matter, produce apparently contending or opposite phenomena; but there would be no reason whatever for entertaining a supposition that they were due to the innate motion of the particles of matter.

The force employed in generating magnetism by percussion is, in most instances, considerable, repeated smart strokes being necessary to effect it. We may, for argument's sake, suppose this to be one of the means by which decomposition, as it is said, takes place. Now this produces a motion of the body struck, and also a vibration of the particles of fluid contained in its interstices; but I see no reason to suppose this motion would separate the particles of one kind of fluid from those of another, and cause them to attract and repel. The same remarks would hold good of any other operation whereby magnetism is induced, that I might suggest within the bounds of probability.

Whether in a state of combination or decomposition, matter is inert, and consequently, neither an atom, nor any mass of atoms, can have the power of motion to or from each other of themselves. But bodies have motions which are known as "attractions," and "repulsions," and we must look to some external power for their causation.

There is a remarkable facility in accounting for these and numerous other phenomena through this dogmatical term, "attraction," because it silences all argument, suppresses all investigation, and renders the exercise of reason unnecessary. We say, what is attraction? Philosophy tells us that it is an abstract principle of nature, an inherent property of matter, and there 's an end of it. What is the evidence of this? Why the most unsatisfactory and inconclusive possible. It is true, two magnetic bodies approximate towards each other, (and, by the way, I may add, they repel each other as well.) Two suspended lead balls exhibit an affinity; and an apple, when it falls from the tree, does so towards the centre of gravity; but nevertheless, these afford us no proof of their doing so through any inherent property of either the magnet, the lead, or the apple. The phenomena exhibited by them are indisputable evidences of a constant condition or mode of matter, but none whatever of an attribute of it.

It is not many years since it was supposed, even by men having pretensions to philosophical celebrity, that magnetical phenomena were produced by a large magnet, which revolved on an axis in the centre of the earth; but this being insufficient to account for all the magnet phenomena, recourse was had to another, which was supposed to revolve about this first one in an opposite direction. The two

were, however, discovered to be as ineffectual for the end as the single one.

At the time this theory was advanced it was believed that the earth possessed the power by which all magnetic powers are controlled—that is, that it was endued with all the properties which a magnet possesses. Experience proves that it has no power of the kind whatever, and I will predict that, ere long, the doctrine of general attraction will be admitted to be equally as fallacious as either of the two hypotheses I have adverted to.

This theory of "the two fluids" puts me somewhat in mind of the mountain in labour, excepting that its authors have, unlike the mountain, brought forth literally nothing. For, after clearing away this epitome of fairy land philosophy, of neutrality, inertia, combination, decomposition, attraction, repulsion, insensible displacements, and their inexplicable ramifications—which are as much opposed to revealed nature as anything perverted ingenuity could invent—we find nothing left or achieved but a simple transfer of the difficulty from the magnet to the "fluids."

We know magnets attract each other. This theory coolly tells us they do so because the fluids in them do so. But the question, why do they so, remains still unanswered.

Although attraction is exhibited in these phenomena in immediate connexion and coincident with repulsion, as an inevitable consequence of it, cause and effect, yet it has not been comprehended.

Magnetical attraction is a type of all that class of phenomena called "attraction," and an index-hand guiding us to the solution of this most important and interesting desideratum.

G. Vincent Towler.

Norwich, January 22, 1844.

PNEUMATIC COFFEE-POTS—PLATOW'S.

Sir,—Being a great coffee-drinker, and having used a variety of coffee-pots during the last three or four years, and amongst them Platow's, I have perused with interest the well-meant remarks of your intelligent correspondent N. N. L. on "Pneumatic Coffee-Pots," contained in your last Number. Remarks and suggestions of a similar nature have frequently been made in my hearing by many fellow coffee-drinkers, but experience has convinced me that the simple arrangements adopted by Mr. Platow, are practically superior to all the suggested contrivances I have seen, or heard of, for the improvement of his coffee-pot.

Your correspondent objects to the upper vase, being detached and screwing on and off. In every machine, some labour must be left for the hand, and it appears to me that the mere trouble of screwing and unscrewing the two vessels is amply compensated for by the following advantages, resulting from their separation.

In the first place, a spout may be altogether dispensed with. This appendage to any vessel used on the fire is by itself objectionable; it is exposed to be burnt and unsoldered, thereby throwing the entire apparatus, to which it may be attached, out of order; moreover, it collects soot and dirt, and as every cook will tell us, it is "always in the way."

To get rid of it, therefore, is in fact a gain, if you can ensure by other means equally effective, the only service which it performs, namely, a facility of pouring out the contents of the coffee-pot. Now, whatever surmise may be raised by mere appearances to the contrary, I contend that the round orifice of Platow's pot will permit the easy flow of the coffee, as readily as any spout or beak whatever. This is a matter of experiment, not a point for argument, and, therefore, let any body who doubts the assertion, try it by the fact. After all, what substantial difference is there between the round orifice of this pot, and the mouth of a common bottle? The screw makes none, for being cut *below* the surface the liquor fills the indentations, and flows out without the slightest check. Another advantage effected by the separation of the two vessels, of which Platow's pot is composed, consists in the compactness and lightness of the lower vessel, containing the coffee, when the upper vase is removed. Let your correspondent reflect for a moment on the cumbrous, top-heavy, condition of a machine made after his models, containing four or even three pints of coffee. The size must, of course, be rather more than double that of the capacity, and the apparatus altogether could not be lifted without a considerable effort. Moreover, let him consider how difficult it would be to keep his complex apparatus clean and sweet, with all its corners, and holes, and ledges for receiving and harbouring the dregs of the coffee and other impurities; and then compare with it the smooth unbroken surface of the interior of Platow's boiler, allowing it to be rinsed perfectly clean in less than a minute, and I will appeal to him as a candid man (which I feel confident he is) whether this latter benefit alone does not more than compen-

sate for any fancied inconvenience arising from rendering the upper vessel separable from the boiler? I will add one more advantage, produced by the simple arrangement of having separate vessels joined with a screw, (namely,) the cheaper rate at which the article can be offered to the consumer, probably in the first instance, but at all events in "the long run," since the upper vessel, having little or no wear, will last out several boilers, and a new boiler can always be readily fitted to the old vase.

I believe that I have, in a cursory way, pointed out the chief advantages resulting from the mechanical construction of Platow's coffee-pot. Will you now permit me to add some hints, which may possibly be of use to less experienced coffee-drinkers than myself. Coffee must be *boiled*, to extract fully its virtues. Witness the practice of all nations familiar with this beverage "from the East to Western Ind," and see Dr. Donovan's scientific treatise on this subject in Lardner's Cyclopædia; but the process of decoction must be brief and temperate, not protracted or furious. Platow's separate reservoir, into which the boiling water is lifted, and there kept simmering by the expansive power of the steam below, admirably accomplishes this end, provided the boiler is not placed upon too fierce a fire, and provided the coffee is not kept simmering above two minutes. These are, therefore, precautions to be noted in the use of the machine; and, moreover, in order to prevent the disappointment attendant on the stoppage or slow filtration of the coffee liquor, when the pot is removed from the fire, the felt washer, for rendering the screw-joint steam and air-tight, ought occasionally to be looked to, for if it is torn or displaced, air will enter the boiler, and fill up the vacuum requisite to ensure the pneumatic action of the machine.

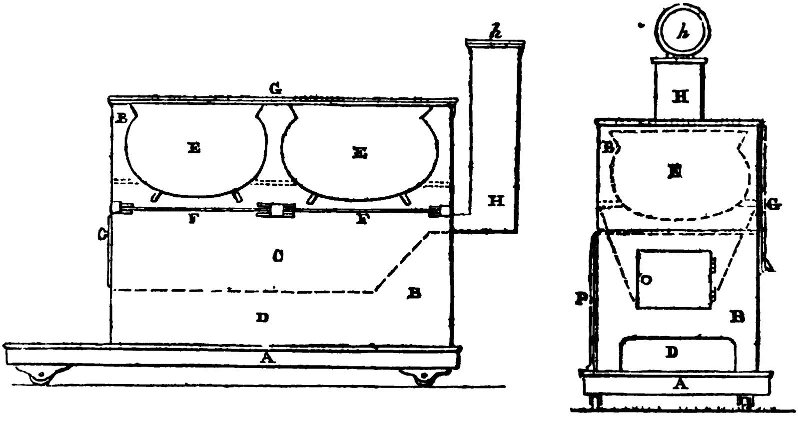
SINDBAD.

January 31, 1844.

PORTABLE SAFETY FURNACE FOR HEATING PITCH, TAR, TALLOW, MARINE GLUE, AND OTHER INFLAMMABLE SUBSTANCES—MESSRS. BROWN AND REDPATH, COMMERCIAL-ROAD, PROPRIETORS.

[Registered under the Act for the Protection of Articles of Utility, January 19, 1844.]

Fig. 1. Fig. 2.



The design of this furnace has been suggested by the danger and inconvenience attending all previous modes of heating pitch and other similar substances in dock and ship-building yards, and on board ship, where every thing around is of so combustible a description. By means of this apparatus the substance can be melted on the spot where it is required to be used, with so little chance, if any, of causing fire, as amply to justify the name of "Safety" which has been given to it. It is made of two sizes; one, which may be carried in the hand, containing a single pot, or couple of pots, capable of holding from four to five gallons each; and the other, mounted on a wheeled truck, fitted with three or more pots of from 10 to 50 gallons capacity. The former is adapted for use on shipboard, the latter for building and dockyards.

Fig. 1 is a side elevation; and fig. 2 a

front or end view of this furnace. A is a hollow basement, on which the oblong case B, which incloses the furnace, pots, &c., is mounted, and which is kept filled with water to protect the deck, or any other wooden flooring on which it may be placed, from injury by the heat; C is the fire-box and D the ash-pit; E E are the pots for holding the pitch, tar, or other article intended to be heated, which rest on bearings as shown in fig. 1; F F are two sliding plates, which, when pushed in, completely separate the pots from the fire-box, but are drawn out when the furnace is in operation, and hang down at the side, suspended by the hinges *a a*, as shown in fig. 2; G is a cover, which turns on a hinge at one end, and may be either brought down upon the pots, as shown in fig. 1, or thrown back, as represented in fig. 2; H is the chimney, which has a hinged lid, *n*, at top, which may be also raised or lowered at pleasure. When on any occasion it is desired to damp the fire, or to shut it off altogether, this can be done almost instantaneously by means of the sliding plates F F, and the covers G and H, one or other, or all of them.

CONTRIBUTION TOWARDS A HISTORY OF ELECTRO-METALLURGY. BY HENRY DIRCKS, ESQ.

In looking over the *Mechanics' Magazine* for several years past, my attention was rather particularly attracted to vol. xxxvi. for 1842, in which appears a paper, entitled, "Books on Electro-Metallurgy,"—a review of the works of Mr. G. Shaw, and Mr. A. Smee on that subject. The writer says, "On a former occasion (vol. xxxiii., p. 20,) we stated our reasons for assigning to Mr. Thomas Spencer, of Liverpool, in preference to every other claimant, the merit of this exceedingly valuable addition to our manufacturing processes; and nothing has since transpired to induce us to modify in the slightest degree the opinion that we then expressed on this head." It is added, "we are sorry to see that there still exists in certain scientific circles the same dogged reluctance, on which we before animadverted, to do justice to the humble 'carver and gilder* of Liverpool,'—for no better reason, that we can discover, but the sin of being humble." And further on, says, "Be it so, since the fact is so, that it was by 'ACCIDENT' Mr. Spencer made the discovery, still it was an *accident* of that happy sort which happens to but one or two men in an age, and which, by the universal consent of mankind, entitles him to whose lot it falls, to be looked upon with all the respect, honour, and gratitude, due to the chosen instrument of any great revelation by nature to her children." The only liberty taken with this extract, is that of printing the word "accident" first in capitals, and afterwards in italics. How far Mr. Spencer has been indebted to *accident*, the sequel will show.

The earliest application of galvanic action to a useful and ornamental purpose that I am acquainted with, was practised by Mr. Henry Bessemer, of Baxter-house, Camden Town, who, above ten years ago, employed the galvanic apparatus to deposit a coating of copper on lead castings. The specimens I have seen are antique heads in relief, the whole occupying a space of about 3 inches by 4 inches. They have lain as ornaments on his mantelpiece for many years, and have been seen by a great number of persons.

The earliest published account of the manipulation requisite for obtaining casts by galvanic action is contained in the letter of a Mr. C. J. Jordan, dated 22nd May, 1839, and published in the *Mechanics' Magazine*, for June 8, 1839. This letter is so interesting in connexion with the history of electro-metallurgy, that I repeat it here; in particular, I would direct attention to the fact of the main incidents named by Mr. Jordan, published June 8, 1839, agreeing with those published by Mr. Spencer, September 12, 1839; and, curious enough, being called forth by the same vague announcement of Professor Jacobi's experiments, which was then making the round of our periodicals. Both parties describe, Dr. Golding Bird's small galvanic apparatus; one used a printer's type, the other a copper coin; and both recommend the application of heat to re-

* Mr. Spencer, as a master carver and gilder, occupying a large house and fine shop, in one of the leading thoroughfares, might have been justly offended at this designation; unless it is merely meant that in certain circles it is deemed humiliating to be of any but the learned professions.

move the precipitated copper. The letter is as follows:—

Engraving by Galvanism.

Sir,—Observing in the last page of a recent Number of your Magazine, a notice extracted from the *Athenæum*, relative to a discovery of Professor Jacobi, its perusal occasioned the recollection of some experiments performed about the commencement of last summer, with the view of obtaining impressions from engraved copperplates, by the aid of galvanism, which led me to infer some analogy in principle with those of the Russian Professor, and may probably give me the right to claim priority in its discovery and application. These experiments were abandoned from the want of that most important element in pursuits of this nature, time; the writer's share of the said element being occupied in a manner more imperative than pleasing. I regret, however, not having made it the subject of an earlier communication, as this would have placed my pretensions beyond doubt; but inasmuch as the notice alluded to is given from memory, and is undescriptive, while I may be enabled to exhibit the *modus operandi*, my assertion may be at least partially substantiated.

It is well-known to experimentalists on the chemical action of voltaic electricity, that solutions of several metallic salts, are decomposed by its agency, and the metal procured in a free state. Such results are very conspicuous with copper salts, which metal may be obtained from its sulphate (blue vitriol) by simply immersing the poles of a galvanic battery in its solution, the positive wire becoming gradually coated with copper. This phenomenon of metallic reduction is an essential feature in the action of sustaining batteries, the effect, in this case, taking place on more extensive surfaces. But the form of voltaic apparatus which exhibits this result in the most interesting manner, and relates more immediately to the subject of the present communication, may be thus described:—It consists of a glass tube, closed at one extremity with a plug of plaster of Paris, and nearly filled with a solution of sulphate of copper; this tube and its contents are immersed in a solution of common salt. A plate of copper is placed in the first solution; and is connected by means of a wire and solder, with a zink plate which dips into the latter. A slow electric action is thus established through the pores of the plaster, which it is not necessary to mention here; the result of which is the precipitation of minutely crystalized copper on the plate of that metal, in a state of greater or less malleability, according to the slowness or rapidity with which it is deposited. In some experiments of this nature, on removing the copper thus formed, I remarked that the surface in contact with the plate equalled the latter in smoothness and polish, and mentioned this fact to some individuals of my acquaintance. It occurred to me, therefore, that if the surface of the plate was engraved, an impression might be obtained. This was found to be the case; for on detaching the precipitated metal, the most delicate and superficial markings, from the fine particles of powder used in polishing, to the deeper touches of a needle or graver, exhibited their correspondent impressions in relief with great fidelity. It is, therefore, evident that this principle will admit of improvement, and that casts and moulds may be obtained from any form of copper.

This rendered it probable that impressions may be obtained from those other metals having an electro-negative relation to the zink plate of the battery. With this view, a common printing type was substituted for the copperplate, and treated in the same manner. This also was successful; the reduced copper coated that portion of the type immersed in the solution. This, when removed, was found to be a perfect matrix, and might be employed for the purpose of casting, where time is not an object.

It appears, therefore, that this discovery may be turned to some practical account. It may be taken advantage of in procuring casts from various metals, as above alluded to; for instance, a copper die may be formed from a cast of a coin or medal, in silver, type metal, or lead, &c., which may be employed for striking impressions in soft metals. Casts may probably be obtained from a plaster surface surrounding a plate of copper; tubs (tubes?) or any small vessel may also be made by precipitating the metal around a wire, or any kind of surface, to form the interior, which may be removed mechanically, by the aid of an acid solvent, or by heat.

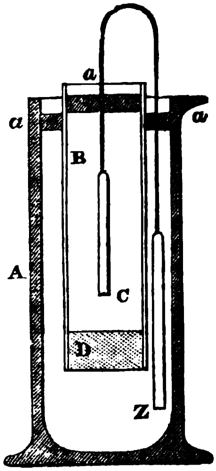
C. J. JORDAN.

May 22, 1839.

I was aware of Mr. Jordan's letter at the time of its publication, and have frequently been surprised since, that his name has not transpired in any discussion I have heard on the subject. Nothing certainly can be clearer than his reasoning, the details of his experiments, and his several concluding suggestions.

It was particularly in September and October, 1837, that several parties attached to scientific pursuits in Liverpool, were engaged in repeating the experi-

ments of Dr. Golding Bird, published in the Phil. Trans. for 1837, and of which he gave an account before the chemical section of the British Association at its Meeting in Liverpool, over which Dr. Faraday presided. The apparatus used



on that occasion by myself and others, was precisely that recommended by Dr. Bird, consisting simply of any glass vessel A, capable of holding a solution of common salt, into which is inserted a gas-lamp chimney, having its lower end plugged up by pouring into it plaster of Paris D; a solution of sulphate of copper is then poured into it, and the whole immersed in the contents of the glass A, and tightened with pieces of cork *a*, *a*, *a*; C is the copper, and Z the zink plate. The result expected from this arrangement was the deposit of metallic veins of copper within the plaster diaphragm, independent of any connexion with the poles of the battery. Dr. Faraday and every other electrician expressed surprise and doubts at the results in this respect, said to have been obtained by Dr. Bird, and Dr. Faraday particularly urged the necessity and importance of caution in receiving as established a result so greatly at variance with all former experience, and proceeded to explain a variety of causes tending to lead to fallacious results in this curious and interesting experiment.

I have still by me the crystals of copper obtained by myself in my first experiments in September, 1837. I was at that time a good deal in communication with Mr. John Dancer, philosophical instrument maker, Liverpool, now of the firm of Messrs. Abraham and Dancer, Manchester, and this was a frequent subject of conversation. It was about October, of the year following, (1838) that Dr. Brett was delivering lectures on electricity and galvanism at the Medical Institution, Liverpool, and being in communication with Mr. Dancer respecting the apparatus for those lectures, I was arranging for a supply of galvanic troughs, when Mr. Dancer showed me a ribbon of copper, thin but very firm, granular on one side, while it was bright, and smooth, all but some raised lines, on the other. Seeing my curiosity a good deal excited, he said at once, it was the result of galvanic action, and explained the whole process. He particularly noticed that generally the deposit was more crystalline, granular, and brittle. The difference of the specimen I was examining, which possessed all the tenacity of rolled copper, he attributed to his having gone to the potteries to look out suitable jars for forming sustaining batteries, and having fixed on a lot which he was told would not answer as *they were not glazed*, and would not hold liquor. The idea immediately occurred to him that such *unglazed* jars might be turned to account and used instead of bladder, brown paper, plaster of Paris, and other porous substances, he had previously employed. He, therefore, immediately obtained a sample for experiment, and the result was a more firm and compact deposition of copper, though that was not what he was seeking, his object being durability and equable action. But Mr. Dancer was not negligent of the accidental discovery of a deposit possessing such tenacity as belonged to the copper resulting from batteries, in which he employed porous earthenware; neither did he make any secret whatever of the occurrence. A specimen of the copper he obtained by that process, was shown by me the same day to Dr. Brett in the laboratory of the Apothecaries' Hall, Liverpool, who was equally unable with myself to guess the mode by which it had been obtained. When informed of the process he was much gratified by the statement.

These facts were named by Mr. Dancer's friends to various persons, and in my capacity of Honorary Secretary, at the

time, of a Literary and Scientific Institution, this curious electrical experiment of Mr. Dancer's was frequently a subject of conversation.

Subsequently, Mr. Spencer laid claim to the discovery of the means for obtaining metallic casts by galvanic agency, and having, with others, expressed doubts of Mr. Spencer's claim to priority, I was surprised when verbally informed by Mr. Spencer, that I was quite in error in repeating such statements, and that so far from its being the fact, Mr. Dancer had "made the *amende honorable*." This statement, which appeared to me a very extraordinary one, induced me to write a note of inquiry to Mr. Dancer, and the following is his reply:—

"21, Pleasant-street,
Liverpool, 17th June, 1840.

"Dear Sir,—Since I saw you I have scarcely had ten minutes to spare, and at present I have not time to enter fully into detail. With respect to the precipitation of copper for the purpose of obtaining an impression, I give you the following account, (part of which I believe you were aware of in 1838), and is in fact, the substance of a letter written by me in reply to Mr. T. Spencer. I stated that I had been engaged, in connexion with Mr. Unsworth, in experiments with batteries of various constructions, previous to my acquaintance with Mr. Spencer, and I had used various porous substances in my batteries (which were those excited with common salt and sulphate of copper). To prevent the intermixture of the solutions—in one I had used a thin plaster division, and I obtained a very compact deposition of metallic (copper) on the copper plate of my battery, which I pulled off. I recollect Mr. Unsworth and I talking of it as one method of multiplying our battery plates, while we were making use of the battery. From this I was led to try if I could precipitate a larger and more uniform plate, and I succeeded in doing so. I afterwards thought that unglazed jars, such as I could obtain at the Pottery, would be more durable for the porous division, and, on trial, I found them answer very well; with these I could obtain the copper more uniform.

"I met Mr. Spencer one morning in Berry-street, and I happened to have one of these precipitated copper plates with me, which I showed to him. When I told him how it had been formed, he would scarcely believe it, until I pointed out the impressions in relief, of all the minute scratches that were on the plate, against which it had been deposited. The surprise that Mr. Spencer expressed very naturally led me to suppose that it was the first compact piece of precipitated copper that he had seen. I believe it was the same which I sometime after gave you, and which you showed to Dr. Brett. I had also reversed* the experiment of Dr. G. Bird, using the solution of copper outside, and I placed a piece of sheet copper at the bottom of the glass, and in connexion with the zink which was in the gas glass; on the copper I fastened, by means of varnish, a letter D, cut from a printed bill. The copper precipitated on all parts of the plate except where the letter was fixed; when I peeled the precipitated copper off, the letter came out, not having any connexion with the outside edge. I also obtained an impression by stamping my name on a copper cylinder, the impression being the reverse way. All these experiments were well known to persons about my place, and are well recollected by them and all who were in the habit of calling. You will recollect no doubt the many conversations we had respecting the deposition of copper. All this happened many months before I was aware that Mr. Spencer had been engaged in anything of the kind, except that he had Dr. Bird's experiment in action. Sometime after this Mr. Spencer applied to me for one of my porous jars, and one evening at his house he told me the purpose for which he wanted it,—he stated that he intended to form ornaments by gilding patterns of plaster and depositing copper on them; he stated also, that it would be of great use in his business. The same evening I told him of my having obtained impressions by stamping my name on a copper cylinder.

"I saw a notice in the *Liverpool Mercury*, May, 1839, to the effect that Professor Jacobi was engaged in producing fine lines on copper by means of galvanism, and that Mr. Spencer, of Liverpool, had been engaged in the same manner.

"You will recollect that when Mr. Spencer brought the subject before the Polytechnic Society,† that you and others also, that knew I had been experimenting in the precipitating of copper, expressed great surprise that I did not make some mention of it. The reason I gave you at the time was, that being acquainted with Mr. Spencer, I thought it would look like envy, or a wish to detract from the merits of his experiments, and share the honour without having brought it to any practical use; but as he has stated to you,

* This remark of Mr. Dancer will be immediately understood by a reference to the diagram before given, which is just the reverse of his description.

† He gave notice of his paper 8th May, but did not bring it forward till 12th September, 1839.

and others, that I had made the 'amende honorable,' which insinuates that in the letter I sent to him (to explain the grounds on which I stated that I had showed to him the first compact copper by precipitation that he had seen), I had been retracting, or making some apology, for what I had stated—you will be able to judge from this statement of undeniable facts whether I have been misrepresented.

"The whole of the matter may be summed up thus,—I never did, nor ever wished, to take credit for Mr. Spencer's experiments; but if he had, as he now states, produced compact precipitated copper at the time when I showed him the piece in question, he was wrong in allowing me to suppose otherwise; and that whether he had or not, the experiments that I tried, originated with me, in the manner described, and this is all I have ever desired to maintain.

"Yours truly,
"JNO. DANCER.

"Henry Dircks, Esq."

Mr. Thomas Spencer read his paper "*On Voltaic Electricity applied to the purpose of working in metal,*" before the Liverpool Polytechnic Society on the 12th September, 1839. He purposed making this matter the subject of a paper intended to have been read at the Meeting of the British Association, in August, at Birmingham. He had announced to the Polytechnic Society on the 8th May, that he had a communication of this nature to make, and he did so at that time, and in that manner, in consequence of a paragraph appearing in the public prints, that Professor Jacobi was engaged on experiments in engraving by galvanic action. The same year the Society printed Mr. Spencer's paper for gratuitous circulation. Mr. Spencer, in this paper, claims to have been engaged on the subject of it for two years, dating, in short, from September, 1837, the very period when Dr. G. Bird read his paper at the Liverpool Meeting of the British Association. He says, without the least acknowledgment of the apparatus being the identical ingenious one then suggested by Dr. Bird, "In September, 1837, I was induced to try some experiments in electro-chemistry, with a single pair of plates, consisting of a small piece of zink, and an equal sized piece of copper, connected together with a wire of the latter metal." It is unfortunate for the reputation of Mr. Spencer, that while the Society was at the expense of publishing his paper to uphold his claims, he should make that very paper the vehicle for underrating and undervaluing not only the labours of others, but actually the labours of experimentalists to whom he was indebted for the germ of his own experiments in electro-metallurgy. The "humble 'carver and gilder of Liverpool,'" designates the learned lecturer at Guy's hospital, "a clever young demonstrator (Dr. Bird of London)," and speaking of Dr. Bird's experiments before alluded to, this same "humble" individual very complacently observes, in reference to obtaining crystals of pure copper within the plaster diaphragm of the apparatus, "I doubted this at the time, as it was opposed to all former experience." Not a word that Dr. Faraday had spoken at considerable length on this very point—not denouncing it as a decided error, but suggesting with that delicacy of remark and philosophical acuteness of observation for which he is remarkable, various reasons for further enquiry and consideration. Mr. Spencer at one dash takes to himself the merit of singular shrewdness of observation in this matter. Mr. Dancer had produced an indent, in the shape of a D, on the deposited copper, where a letter, cut out of paper, had been attached by varnish to the copper plate. Mr. Spencer details, as a discovery of his own, indents on the deposited copper, where some sealing wax varnish had dropped on the copper plate.

It shows a singular want of observation and ingenuity on the part of Mr. Spencer, a carver, and claiming acquaintance with friends, "some of whom are connected with the public press," that he should not have seen, or did not try to obtain, a wood block engraving previous to making the laborious experiment of trying to obtain a copper plate for printing, with lines in relief "one-eighth of an inch in thickness!" when a mere hair line would have sufficed.

Mr. Spencer experienced great difficulty to avoid the brittleness of the copper deposit, and tried plaster of various thicknesses, and solutions differing in strength, in all of which he seems to have displayed considerable perseverance; and, which, besides what he sought, led him to the discovery that by a clean surface the coating of copper became adhesive;

and the reverse, if not freed from grease, or oxidation, by employing a solution of nitric acid.

Mr. Spencer's paper is divided into two portions. The first refers to executing engravings, the second to forming moulds and castings of medals, ornaments, &c., and are said to have all been made simultaneously, that is between Sept. 1837, and May, 1839. Whether any improvements between May and Sept. 1839, are introduced, is not stated, neither do any letters or affidavits accompany the communication. Specimens illustrating the progress of the experiments from first to last were exhibited to the Society, 12 Sept. 1839, showing some of the early specimens, of a very brittle and useless character for any purpose in the arts; and here it was that Mr. Spencer received a most valuable hint from Mr. Dancer, whose experiments were not only freely communicated to him, but his very apparatus obtained from him by Mr. Spencer; yet without the least acknowledgment then, or since, of having acted otherwise than by his own unaided judgment. Yet we see that the first promptings were given at the Liverpool meeting of the British Association, by Dr. G. Bird's simple and very ingenious little galvanic apparatus—that the scientific journals were rife with discussion on applications of galvanism to useful purposes of the arts—that Mr. Jordan, a correspondent of the *Mechanics' Magazine*, in the plainest and most intelligible terms, explains identically what Mr. Spencer has a little, and but very little elaborated. Lastly, therefore, that, through the *Mechanics' Magazine*, (which Mr. Spencer was regularly taking in), the experimental results obtained by Mr. Dancer, and the reports, in April and May, 1839, in the public papers, of Jacobi's experiments, all bring such broad hints and abundant assistance to aid Mr. Spencer, that he is rather to be praised for his application to the extension of what was already known on a smaller and less perfect scale, than to be adjudged a discoverer, much less "the father of electro-metallurgy," having "a preference to every other claimant." He commences his paper by saying, "I do not profess to have brought forward a perfect invention." He should rather have said, "*I do not profess to have brought forward a perfect* improvement of what has already been crudely suggested by others."

It is a remarkable fact that Mr. Spencer has made no useful or profitable application of the electrotype process, of which his first experiments gave promise; neither did he early secure its applications by patent right, patenting only, at an after period, a portion of the process, of little or no benefit to him. The consequence has been that he has been left immeasurably in the background. It does not say much for Mr. Spencer's possession of originality of genius and philosophical acumen, which a perusal of his paper on voltaic electricity would persuade us he considers belongs to him, so long to have remained an absolute cypher in an art entirely new, and capable of modifications and applications yet untried.

The facts now set forth have slumbered near seven years, and are only now given lest they should be entirely lost. I have every possible respect for Mr. Spencer for what he *has* done; but common candour obliges me to own that I consider that he has only followed in the footsteps of others, repeating their experiments with some little improvement; but certainly neither at the first originating a new art, nor afterwards doing much to add to its resources, or promote its progress.

London, January, 1844.

[Mr. Dircks has proved beyond all doubt that we have made a great mistake in advocating so strenuously the claims of Mr. Spencer to the invention of electrography. No one, however, can suppose that we would intentionally exalt any one at the expense of our own journal, which we are now pleased to find was the honoured medium of the first distinct revelation of this important art to the public, by an old and esteemed correspondent of ours, Mr. Jordan. Whatever Mr. Bessemer, Mr. Dancer, or Mr. Spencer, or others may have previously said or done, it was in private—made no secret of perhaps, but still not communicated to the public at large—not recorded in any printed work for general benefit. For anything previously done by any of them, the art might have still remained in the profoundest obscurity. No published description of an earlier date than Mr. Jor-

dan's can, we believe, be produced; and when we look upon that description, it is really surprising to see with what fulness and precision the writer predicated of the art, nearly all that has been since accomplished. In supporting, as we did, the claims of Mr. Spencer, to be considered as the first discoverer, we had lost all recollection of Mr. Jordan's communication. We had no personal acquaintance with either of the gentlemen, and could have no motive for favouring one more than the other. We took up the cause of Mr. Spencer with spontaneous warmth, because we thought him to be a person most unfairly and ungenerously used; as in truth he was, so far as the intention went, by those who having at the time none of the reasons we now have, for questioning Mr. Spencer's pretensions, yet obstinately refused to acknowledge them. If it should seem to the reader more than usually surprising that Mr. Jordan's paper escaped the recollection of the Editor, through whose very hands it passed to the public, his surprise will be lessened, perhaps, when he observes, how it appears to have also escaped the notice, or been passed over in silence, by every one else down to the present moment—even of those, not a few, who have expressly occupied themselves with the history of electrography—Mr. Noad, for example, whose very candid and impartial work we reviewed in our last Number, and who specifies the *Mechanics' Magazine* as one of the publications which he consulted in its preparation. To us the most surprising thing of any connected with the case, is, that neither Mr. Jordan himself, nor any of his friends, should before now have thought it worth while to vindicate his claims to the promulgation of an art which justly entitles him to take a high place amongst the benefactors of his age and country.—Ed. M. M.]

MR. AUSTIN'S METHOD OF FITTING SHIPS' BOATS AS LIFE-BOATS, IN CASES OF SHIPWRECK, AND OF RAISING SUNKEN VESSELS.

Mr. Austin, formerly Harbour-Master at the island of Heligoland, suggests the following plan as sufficiently simple to be within the reach of every vessel in such emergencies:—

When a vessel is driven on the rocks, sands, or shore, or founders at sea, in getting the boats over the side they are frequently stove alongside the wreck before the tackles can be unhooked, and, if even cleared off the tackles, it too often occurs that they are stoved, swamped, or upset, when brought alongside to receive the passengers and crew. To avoid such calamities, Mr. Austin recommends that every boat, before she is launched over the side, should be fitted as a life-boat, with canvass cases on each side, of the whole length of the boat, having a round head at either end marled on to a good hawser or small chain, and secured round her at light-water mark, tautened up by nettles to the gunwale. The cases may be cut out of good topsails or courses, and made from two to three feet in diameter; another case of lighter cloth, of duck, or even of calico, should be made, rather larger in dimensions, and placed within the stout canvass case, each case having three flexible tubes or pipes inserted at the bottom part, one near to each head, and one in midships, made of raw hide, India-rubber cloth, or several thicknesses of canvass, about a fathom in length, and half an inch in diameter, with a mouth-piece or pipe to be blown into, and stopped or corked. The long-boat and skiff should be placed on two spars projected over the side, for the purpose of launching them; the cases well saturated with water, filled with air, stopped, and the boat launched, with plenty of warp slack under foot, and not brought up with less than half a cable, each boat having only two hands in her when launched, with a line passed round them and stopped to the thwart, to bale her out, and to receive the passengers and crew, who should have a smaller similar case placed round each of them.

The boats so fitted would contain with safety double the number of persons they could possibly hold under ordinary circumstances, and would not be upset in a heavy sea, and on going on a lee-shore would hold together and drive well up.

If the weather and sea should admit of the boat's being brought alongside the wreck, the cases being filled with air would serve as flexible fenders, and allow her taking in a number of persons to be removed to the other boats.

Raising Sunken Vessels.

According to Lloyd's List, taking an average of three years, not fewer than 557 vessels are sunk or altogether lost annually.

A vessel having gone down, the first ope

ration is to ascertain her position as nearly as possible, by sweeping with a rope of sufficient length, having two leads affixed thereto, at about sixty fathoms apart, the object of which is to draw the rope along the bottom till it meets with an obstruction. It is easily ascertained by sounding whether the obstruction to the progress of the sweeping-rope is caused by the vessel, or by an anchor or other object; if it be the vessel, it is necessary to ascertain the position in which she lies; this is done by again sweeping the vessel with a small working chain, properly buoyed at equal distances, which will show her length and beam. To ascertain if the bowsprit is still standing, it is necessary to sound again at each end of the vessel. The purchase-chain is next passed round the vessel, having a sufficient number of collapsed air-cases (formed as above described) shackled on to it, and when tautened round her by means of other cases, or purchase-lighters, the chain is effectually secured round the vessel by stoppers. The operation of filling the air-cases is next proceeded with, which is effected by powerful air-pumps, on board a steam-vessel taken out for the purpose, and as the displacement of the water is going on the vessel is gradually being raised from her bed, and by the time they are filled she will be above the surface of the water, and ready to be towed to shore by the steamer.—*Trans. Soc. of Arts.*

NOTES AND NOTICES.

The Royal Society's Gold Medals for 1843 have been awarded to Professor Forbes of Edinburgh, for his "Researches on the Law of Extinction of the Solar Rays," and to Professor Wheatstone, for his "Account of several New Instruments and Processes for determining the Constants of a Voltaic Circuit." The *Copley* medal has been awarded to M. Dumas for his "Researches in Organic Chemistry."

Zink Milk-pails.—The following extract will show the danger and folly of the practice of keeping milk in zink bowls, a custom which has become very prevalent, from a notion that a larger quantity of cream is produced through a galvanic action taking place between the milk and the zink. "I would scarcely have believed," says Dr. Elanes, of Berlin, "that zink vessels could again have come into use for holding any fluids used for alimentary purposes, as Vauquelin forty years ago proved that such were certain, after a short time, to hold a considerable portion of zink in solution. I have found by experiments that a solution of sugar, which had stood only a few hours in the summer in a zink vessel, contained a considerable amount of zink salts. It has been often stated that the cream will separate more easily from milk if the latter be kept for a short time in a zink vessel. As, however, it is known that milk will turn acid much sooner than a solution of sugar, it is the more to be apprehended that some zink will be dissolved, and such milk will be the more noxious, as it is well known that even a small amount of zink will cause violent spasmodic vomiting."—*Pharmaceutical Journal.*

Speculations by Professor Faraday on the Nature of Matter.—At a recent Meeting of the Royal Institution, Professor Faraday delivered a very remarkable discourse on the subject. He stated, that his object was, not to originate a new theory, but to induce reflecting minds to reconsider the generally admitted views of the nature of matter. The prevalent idea of the constitution of matter, was that it consists of innumerable infinitely minute particles, held together in the *solid* state by the attraction of cohesion, neutral to each other in the *liquid*, mutually repulsive in *gases* or *vapours*. As this change of form in matter is usually referred to the effect of heat, it would seem to follow that this influence of heat is effected by detaching the particles from each other, so that the whole mass is made to occupy a larger space (as when water is converted into steam). Quitting this mechanical theory of the nature of matter, Mr. Faraday, rapidly touched on its modification in the atomic theory of modern chemistry. This theory, as is well known, consists in the assumption that atoms of elementary substances, when brought together by chemical affinity, form one atom of a compound body (as when an atom of hydrogen unites with an atom of oxygen, to form an atom of water). All these accepted notions of matter, Mr. Faraday declared to be mere assumption, involving, in some instances, absolute contradictions. The common physical law of bodies expanding by heat and contracting by cold is contradicted by the fact that water expands, instead of contracting, when below the temperature of 40° Fahr. On the other hand, the chemist is obliged to have recourse to *half atoms* (*i. e.* divisions of what he defines as indivisible), as in the salts of phosphorus and the oxides of iron and some other metals. But in the phenomena of electricity, the greatest difficulties to the general views of the nature of matter are presented. It is well known that bodies may be classed as conductors or non-conductors of electricity. Of two equally solid substances, copper conducts, shell-lac insulates; and yet if, according to the universally recognized opinion of matter, the particles of each are surrounded by space or ether,—why does this theoretical atmosphere exhibit properties so opposite? Why does it conduct in copper and not conduct in shell-lac? Again, in general, metals conduct worse when heated, and better when cooled, yet iodide of mercury will not conduct at all till it is fused. But the most striking anomaly in the popular opinion mentioned by Mr. Faraday is, the opposite electrical properties of the metal potassium in its metallic state, and when it is oxidized. In the former condition, it is lighter than water, and *conducts electricity*; in the latter, its specific gravity is doubled, twice the number of particles of potassium entering into the same space, and yet then it will not conduct at all. Mr. Faraday concluded by avowing that the impression produced on his mind by these difficulties in the received theory of matter was, that matter consists of centres of fires, around which the forces are grouped; that particles do touch, and that the forces round those centres are melted; that wherever this power extends, there matter is; that wherever the atmospheres of force coalesce, there the matter becomes continuous; that chemists need not group atoms together, as in the case of berberine, or other organic substances, to make their composition intelligible, but that particles can penetrate each other.

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MASTERS' PATENT ICE-MAKING APPARATUS.

Fig. 1.

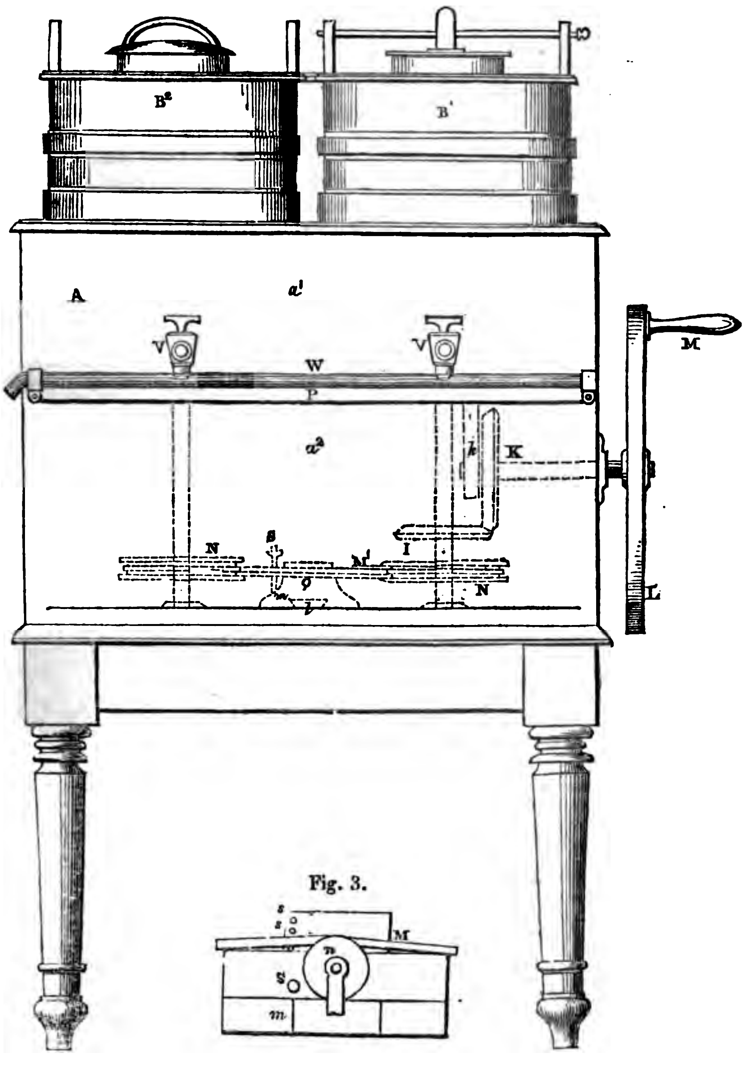


Fig. 3.

MASTERS' PATENT ICE-MAKING APPARATUS.

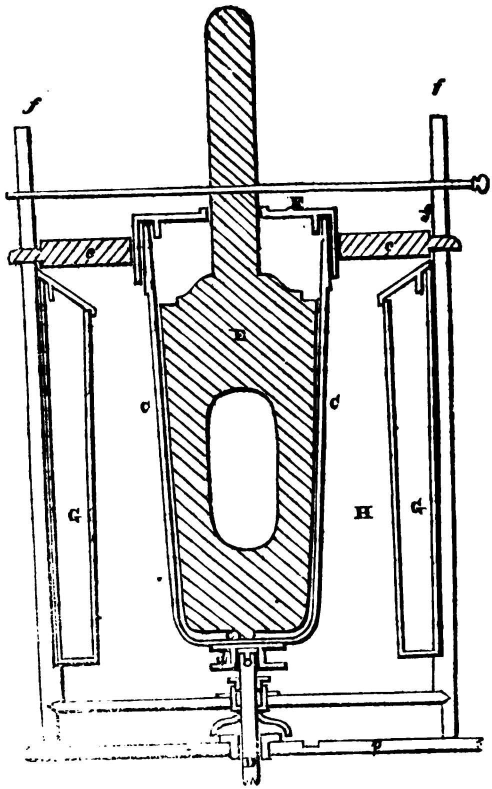
[Patent dated July 6, 1843; Specification enrolled, January 6, 1844.]

Considering how long we have been familiar with various means of artificial congelation—for half a century at least—and how eagerly in this country every discovery of science is turned to practical account—it is surprising that no one should before now have succeeded in adding to our multitudinous list of useful processes, one of so attractive a character, and of such lucrative promise, as *the manufacture of ice*. It is exactly twenty years since we published in our journal (No. 20, 10 Jan. 1824) a description of an ice-making apparatus, then some six or seven years old, invented by Professor Leslie, by which that eminent philosopher confidently predicted we should be able "to produce ice on a large scale, at all seasons, and in the hottest climates of the globe." His agents were but a peck or so of parched oatmeal, and a good-sized air-pump! But notwithstanding the sanguine anticipations of Mr. Leslie, his apparatus never came into use,—confectioners, restaurateurs, and others, still supply themselves as of old with ice of nature's own making; and in countries where the thermometer never or rarely descends to the freezing point, the inhabitants are content to import their supplies at a vast expense from the (in this respect) more *favoured* regions of the north. The cadger-providers of our Gunters and Vereys continue, as in the days of Pepys, to lay every suburban pond, "from Stratford marshes to Wilsden Bottom," under contribution; Rotterdam exports to Naples—New York to Calcutta and Hong Kong. The ice trade between North America and the East Indies employs of itself several ships; and the Patent Office at Washington is seldom without some application before it for some new mode of transporting the commodity. We have heard the neglect of Leslie's ingenious scheme for saving all this vast trouble and cost, accounted for on the ground that there was nothing to be saved by it; and it is not improbable that the fact was found to be so; for air-pumps of a capacity adequate to the manufacture of ice "on a large scale" are dear articles, difficult to keep in order, and at best of very slow operation.

The apparatus which we have to present to the notice of our readers is destined, if we mistake not, to experience a very different fate. We anticipate nothing less from it, than the speedy and entire abandonment of the present traffic in natural ice. It is on a different principle from Leslie's, of cheap and simple construction, easy to work, not at all liable to get out of order, and wondrously rapid and efficient in operation. You may either have it of a large size, to produce in the shortest time possible a large quantity of ice; or you may, with one of small size, produce the same quantity by repeated operations so rapidly as to make the difference in time a matter of no moment. We have ourselves seen two quarts and a half of ice cream manufactured by one of Mr. Masters' machines little bigger than an ordinary teapoy, in less than four minutes; in an hour it would have produced full thirty quarts, (allowing for the time taken up in emptying and refilling,) which is more than enough for the largest private party. We saw also a circular tub or pail of ice, of about an inch thick, and ten pounds in weight, intended to serve as a wine cooler, produced on the same occasion within half an hour.

Mr. Masters' apparatus may be described in general terms as being simply a rotary churn applied to the purpose of refrigeration. It does, in fact, churn as well as freeze; and herein, so far as the making of dessert ices is concerned, consists one of the most valuable features of the invention. The solutions required to be converted—whether into ice creams, or water ices—are whipped, beaten up, or *churned*, while in the act of freezing. The solutions are placed in vessels surrounded by frigorific mixtures, and caused to rotate with great rapidity; while certain spatulas, which are kept stationary within the rotating vessels, effect the churning part of the process. The inventor mentions a great number of frigorific mixtures as suitable for the purpose—as muriate of ammonia, snow, and common salt; nitrate of potash, snow, and common salt; crystallized chloride of calcium and snow; fused potash and snow, &c.; but he lays no claim to any particular ingredients.

Fig. 2.



Where the cold is not required to be of great intensity, a little natural ice broken up into pieces, or new-fallen snow, will probably answer as well as anything else.

Fig. 1 of the accompanying engravings represents an elevation of one of Mr. Masters' larger machines; and fig. 2, a section of one half of the same on an enlarged scale. The following description of it we extract from the author's specification:—

"A is an oblong box or case, mounted on four legs, which is divided by a partition, *p*, into two compartments, a^1 a^2. The compartment a^1 contains two circular pails, B^1 B^2, which are precisely alike in all respects, and are constructed in the inside in the manner shown in the sectional view, fig. 2. C (fig. 2) is a conical shaped vessel of pewter, for holding the water, cream, or other matter desired to be frozen, cooled, or churned, which is supported in the centre of the pail by the lid, *c c*, at top, and by the bearings, *d d*, at bottom, by which last it rests freely on the end of a spindle D, which passes through the partition *p*, and turns in a socket in the bottom of the second chamber a^2; so that when a rotary motion is given to the spindle D, a like motion is necessarily communicated to the vessel C. E is a single-bladed spatula, which is inserted in the vessel C. F is a cover which is slipped over the handle of this spatula, by an orifice in the centre of it, and brought close down upon the vessel C. F^2 is a rod which is passed through holes made in the lugs, *f f*, of the pail, and through a hole in the handle of the spatula E, in order to keep it steady in the centre of the pail, and prevent it from pressing at any part against the sides.

the drawing (fig. 2) the spatula is represented as resting by a projecting stud *e*, on the bottom of the vessel C; but there are two or three holes in the handle of it at lower elevations than the one through which the supporting rod, F^2, is there shown to be passed, by passing the rod through any of which, the spatula may be more or less raised as occasion may require. The space, H H, between the two vessels, C and G, serves to hold the frigorific mixtures, by which, with the aid of the rotary motion given to the vessel C, the freezing or cooling is to be effected. G is a second vessel, made of zink or other suitable metal, of a circular form, for holding water, or any other matter to which a circular form in the frozen state is desired to be given; this vessel is concentric with, and immediately adjoins, the sides of the pail; it rests at bottom on a ledge in the sides, and is at top covered in with an overlapping lid. I is a horizontal bevel wheel fixed on the spindle D; K, a vertical bevel wheel which works into I, the axle of which is supported at the inner end by a bearing *k*, affixed to the top of the lower compartment a^2, and passes out at the other through the side of the box A. L is a fly-wheel fixed on the outer end of the axle of the vertical bevel wheel K; and M is a handle by which the fly-wheel is turned round, and a rotary motion given to all the parts in connexion with it; namely, the vertical wheel K, the horizontal wheel I, the spindle D, and the conical vessel C. The motion so given to the rotating parts of the first pail, B^1 (that next the fly-wheel), is communicated to the like parts of the second pail, B^2, by means of a strap, M^1, passed round two pulleys, N N, affixed to their respective spindles. Between the two pulleys, and on the front edge of the bottom of the lower compartment, a^2, there is fixed a strap-tightening apparatus, Q, represented separately in fig. 3. The seat, *l*, of this apparatus is made fast to the bottom of the compartment a^2, and is bevelled inwards on its outer edges. *m* is a carriage, which is bevelled in the same way as the seat *l*, and overlaps it, so as to slide freely upon it as in a groove; and *n* is a pulley mounted upon the carriage in a horizontal position, so as to front, or be on a level with, the strap M^1. When it is desired to tighten the strap, the carriage *m* is pushed forward, which causes the pulley *n* to press against the strap M^1, and thereby to tighten its hold on the pulleys; and when it is desired to ease the strap, the reverse course is adopted. S is a screw which passes down through the carriage *m*, into any of the series of holes, *s s*, in the seat *l*, and thereby makes the carriage and pulley fast in any position which may be given to them.

"Suppose the vessels C C and G G of an apparatus, similar to that represented in figs. 1 and 2, to be filled, the former with any of the flavoured solutions from which ice-creams or water-ices are usually made, and the latter with pure water, and that the space H is also filled with some of the frigorific substances or mixtures of substances; rotation is then to be given to the vessels C C, by turning the fly-wheel, and continued till the solutions in the vessels C C are frozen, and (by the action of the spatulas) beaten up into ices of a proper consistency for the table. The time required for this purpose seldom exceeds four minutes. The vessels C C are then to be lifted out, and emptied of their contents for use. No turning is necessary for converting the water in the vessels G G into ice. To effect this these vessels must be left in contact with the frigorific mixture for from 1½ to 2 hours,* and after they are lifted out and before attempting to empty them, they must be placed for a short time in warm water, the heat from which will completely detach the ice within from the sides; they are then to be turned upside down, and shaken a little, when the ice will drop out in the form of a circular block, which may be placed in a wine-cooler, and the bottles of wine within it. V V are taps in front of the apparatus, by which water which may collect in the space H H from condensation, or otherwise, can be drawn off into a discharge-pipe W."

The apparatus is represented in fig. 1 as having but two pails, which is a convenient number for general use; but the number may be increased to three, four, or more, by merely enlarging the apparatus, and connecting the spindles of the additional pails to the common mover, L, by means similar to those employed in the case of the two pails. Instead also of the vessels G G being of a plain circular shape, they may be made of any other shape which will allow the blocks of ice formed in them to drop out freely; so that these blocks may be made of a very great variety of forms, fanciful and ornamental.

An apparatus having one pail only, and excellently adapted for domestic use—being equally adapted to the churning of butter or to the making of ices—is represented in fig. 4 (an elevation), and

* *Sic* in specification, but, as before stated, we saw one of these blocks actually produced in half an hour.—ED. M. M.

Fig. 4.

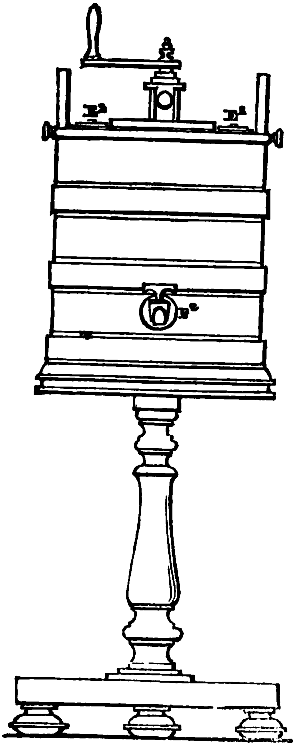


Fig. 5.

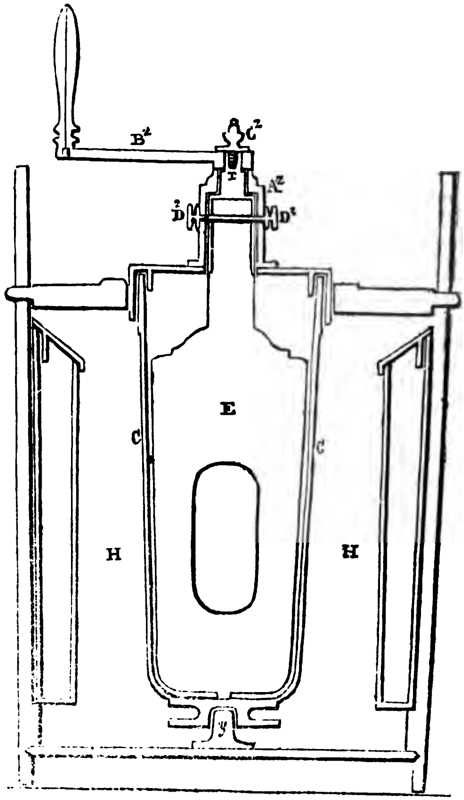


fig. 5 (a section on an enlarged scale). But in this case the machine is worked from the top, instead of from below, as in the larger machine before described, and turns on a fixed pivot at bottom :—

"A^2 is a head-piece, which is brazed on to the lid of the vessel C, and up through which the arm of the spatula E passes, terminating in this case at top in a square nut x. B^2 is a ɔmmon winch handle, which fits on to the ɿuare nut x, and C^2 a screw-cap, by which : is kept fast in its place ; the screw of this ıp passing through the end of the handle, ıd into a female threaded recess in the top f the nut. D^2 is a screw pin, by passing hich horizontally through the outside of e head-piece A^2, from right to left, then rough a hole in the handle of the spatula, ıd finally screwing it into a female threaded ifice in the opposite, or left side of the head-ece, and a corresponding orifice in the shank the screw-head D^3, which serves as a cap to the left hand orifice, the spatula can be made fast when it is not required to rotate. E^2 E^2 are two bolts which slide in frames fixed to the top of the lid of the pail, and take into two holes made into the opposite side of the lid of the vessel C, whereby that vessel also can be made fast when required. When the apparatus is to be employed for freezing and cooling purposes, the spatula is made fast by the screw-pin D^2, and the vessel C left free to rotate, and *vice versa;* when the apparatus is to be employed for churning, or beating up ice creams or water ices, the vessel C is made fast by the bolts E^2 E^2, and the spatula caused to rotate. The rotation in either case is effected by the turning of the winch-handle. F^2 is a cock for drawing off the water from the central part H of the pail."

It should be added that when the machine is used as a butter churn merely, the frigorific mixtures are dispensed

with, and their place supplied with warm water, if necessary.

The larger machine may be also occasionally used as a butter churn in the same way; or one division of it may be so employed, and the other appropriated to the making of ice.

ON MR. HENNESSY'S NEW METHOD OF MEASURING DISTANCES.

Sir,—I promised some time ago (vol. xxxix. p. 325) to offer some observations on Mr. Henry Hennessy's "New Method of Measuring Distances," (p. 276,) and I purpose now, with your permission, to fulfil the promise then made.

Mr. Hennessy calls his method a *new* method; on what grounds he claims for it the merit of novelty it is not easy to see. He says it "consists in the determination of distances by observations with an instrument." The determination of distances, and heights too, in this manner, is as old as the science of trigonometry itself; and it forms at the present time the most usual and best known application of that science. Mr. H.'s claims, in fact, are just about as well founded as would be those of a person who should, at this time of day, bring forward the steam-engine in its earliest and rudest form, and call it an improvement. This I shall endeavour to show.

The principles of trigonometrical measurement are briefly these: a triangle consists of six parts, viz., the three sides, and the three angles. Of these any three being known, one of the three at least being a side, the others may be found by calculation. One method of applying this to the measurement of a distance is so to arrange matters that the line to be determined shall form one of the sides of a triangle, which can evidently be done by assuming a point anywhere on one side of the line. The line joining this point, and either extremity of the line to be determined, is called the base. And this base being measured in any convenient way, and the angles subtended at its extremities by the other two sides of the triangle being "observed with an instrument," the required distance is determined by calculation. Here it may be asked, What is the use of all this work? If one line can be measured in the ordinary way, why may not another? The answer is, It is true that if the other line can be measured in the ordinary way, the labour is useless. But frequently this cannot be done. Part of it may be situated in a marsh, or a river may intervene between its extremities. These, which would be well nigh insurmountable obstacles to ordinary modes of measurement, offer no obstruction to the application of the trigonometrical method. An important maxim to be kept in view in such measurements is, that the triangle should be assumed so as to be as nearly equilateral, or equal-sided, as may be convenient, in order that the part or parts to be determined by calculation may not greatly exceed those of the same species determined by actual measurement; and the reason is, that in this state, errors in the measurement of the base, and in the determination of the angles, produce the least effect upon the result. When there is a large departure from this condition, the triangle is technically said to be an ill-conditioned one, and the results of operations founded upon it are to be viewed with proportionate suspicion.

The angles in the mode of measurement I have described would be determined by the sextant, or some similar instrument, of which I need say nothing more here than that it admits of being very conveniently carried under the arm, and is held in the hand while the observations are being made.

Now Mr. Hennessy, although he seems to claim as new the application of "observations with an instrument" to the determination of distances, as he can hardly be ignorant that this application has long since been made, probably only means that his mode of doing so is an improvement on those previously known and practised. Supposing this to be his meaning, let us see what his method is, and compare it with that above described.* Mr. H., then, proposes to employ what I shall call a portable base, which he erects vertically at one extremity of the line to be measured, with its top on a level with the eye of the observer, standing at the other extremity. Then from this position he "observes with an instrument," the angle of depression of the lower end of the base; and hence, the length of the base, and the angle at its upper extremity (which is a right

* Mr. H.'s method is described on p. 276, but the figure belonging to the description is on p. 275.

angle) being known, he has the requisite data for determining the other parts of his triangle, of which parts the required distance is one.

Now this method may seem to possess an advantage over that previously described, inasmuch as it requires only one "observation with an instrument," and the length of the portable base being determined once for all, no measurement of a base line. I proceed therefore to show that this seeming advantage is far more than counterbalanced by the many disadvantages to which the method is subject.

1. The adjustment of the portable base to the proper height will, unless an assistant be employed, be an exceedingly tedious, if not an impracticable operation. Even with the aid of an assistant, the time required to do this, and to fix and level the observing instrument (operations which are necessary in this method, but not in the other) would more than suffice to determine the two angles according to the first method.

2. Mr. H.'s method can only be applied to the measurement of accessible distances. It cannot be applied, for example, to determine the width of a river, unless indeed a boat be procured to carry over the *portable base* and its apparatus.

3. It cannot be used on an acclivity, but only on ground which is either perfectly level, or declines from the observer. This arises from the particular length he assigns to his *base*, viz., about 5 feet. Since the *top* of this must be on a level with the eye of the observer, if the distance to be determined be on an acclivity, a part, perhaps the whole, of the base will be buried in the earth, and consequently, in either case, no observation could be made.*

4. For any real practical application, Mr. H.'s method will always present us with most peculiarly ill-conditioned triangles. I have already adverted to the tendency of such: we shall see more of their actual effect by and by. Were Mr. H. to confine his method to the purpose for which alone it is adapted, viz., the determination of accessible distances on level ground, not greatly exceeding in length the length of his base, we should be strongly reminded of the proceedings of certain scientific tailors, of whom it is recorded by the learned and veracious Captain Lemuel Gulliver, that, instead of using a tape, as your ordinary tailors would do, they took measure of their customers by "observations with an instrument!"

5. There is another peculiarity in Mr. H.'s method, which I have not yet mentioned; and that is, the sort of instrument he proposes to employ. This instrument is neither more nor less than a sextant (if it be not a misnomer to call that a sextant which contains only about a twentieth part of the circumference,) deprived of all that adapts it to other purposes than the measurement of very small lengths of depression, *improved* by the addition of a level, and magnified to an enormous size. The length of radius in the sextant varies from 6 to 9 inches. The radius of Mr. H.'s instrument, it appears, is to be not less than 5 feet! being "exactly equal"* to the length of the portable base. Mr. H. seems to imagine that an instrument of this size will possess great advantages, in point of accuracy, over one of smaller dimensions, in consequence of the minuter division which it admits of. It would certainly need to do so to place his method on an equality with the other, seeing he is restricted to the use of such ill-conditioned triangles. But I question much whether the instrument will possess any advantage in this respect. It is well known, that of two similar machines, having their parts in the same proportions, the smaller will be *proportionally* stronger than the larger; the reason being, that as the size of the parts is increased, their weight increases much more rapidly than their strength. The effects of this principle in Mr. H.'s gigantic instrument will be a weakening of the parts, a consequent tendency to distortion, and hence a liability to indicate erroneous measurements of his angles. This is not an imaginary objection. The same cause has been found in the Royal Observatory at Greenwich productive of much inconvenience

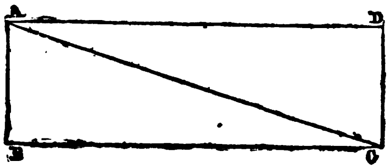
* It will be noticed that in his figure Mr. H. represents the application of his method to *a declivity*.

* Why this condition is introduced it is not easy to determine. I conjecture that this may have arisen from a supposition on the part of Mr. H. that the formula for the elimination of the distance would thereby be simplified by the elimination of the radius. But if Mr. H. will reflect for a moment that the tabular values of the trigonometrical functions are only so many *ratios*, he cannot fail to see, that, using these values, there is no occasion for the introduction of radius into the formulæ in any practical application of trigonometry whatev-

in the case of *fixed* instruments of not above half the dimensions of Mr. H.'s., and carefully supported in every part. What must its effects be then in the case of Mr. H.'s instrument, which will have to be lugged about from place to place upon a man's back, or in some such uncouth mode?

Taking all things into consideration, I am pretty well convinced that five seconds will be rather over than under the amount of error likely to be committed in the use of Mr. H.'s instrument. The effect of such an error in a well-conditioned triangle would be practically quite inappreciable: I propose to inquire what would be its effect in the case of the ill-conditioned triangles to the employment of which we should be restricted in the use of the new instrument.

Mr. H. says, that his instrument "could not find distances of over 500 feet with *perfect* exactness." From this we may understand him to mean, that it will find distances up to 500 feet with *considerable* exactness. Well, let us see.



Let B C be the distance to be measured. D C is the portable base, equal to 5 feet, and if B C be 500 feet, the angle of depression at A will be 34′ 22½″ nearly. To avoid the trouble of interpolation; let us suppose that the true value of the angle at A (which call θ) is 34′ 22″. Then we have B C = D C cotan. θ, or A B cotan. θ,* since D C = A B.

Cotan. θ = cotan. 34′ 22	log.	2·0001220†
A B =	5	0·6989700
B C = 500·14		2·6990900

This therefore is the true length of B C when the angle θ is 34′ 22″. But suppose that observation with Mr. H.'s instrument gives for θ the value 34′ 27″, what will be the length assigned by calculation to B C in that case? Repeating the operation with this value of θ:

Cotan. θ = cotan. 34′ 27″	log.	1·9990701
A B =	5	0·6989700
B C = 498·93		2·6980401

And this differs from the true value by 1·21 feet, or 1 foot 2½ inches! an amount of error quite intolerable in such measurements. The error would of course be less if B C were less. But this suffices to show that Mr. H. has been very ill advised in claiming for his instrument a power of measuring distances up to 500 feet.

On the whole, Mr. Editor, am I not warranted in saying, that the adoption of Mr. Hennessy's method, to the exclusion of that heretofore employed, would be very analogous to a recurrence from the present improved and highly effective state of the steam-engine to that in which it was left by Newcomen and found by Watt?

I am aware that I have in these remarks occupied far more space than the intrinsic importance of the subject that called them forth deserves. But when it is considered that Mr. Hennessy's extraordinary proposition comes before us apparently with the sanction of the British Association, the respect with which we have been accustomed to view that learned body, and the interest generally taken in their proceedings, must plead my excuse.

I am, Sir,

Yours respectfully,

G.

Hermes-street, Pentonville, Feb. 5, 1844.

* Mr. H. writes this expression B C = A B cos θ ÷ sin. θ. But, by the first principles of trigonometry, cos. θ ÷ sin. θ = cotan. θ. Hence the expression ought to be written as above.

† I use Hutton's Tables, which give the logarithmic tangents for every second of the first two degrees, and I take the arithmetical complement of log. tan. for log. cotan.

HORNE'S POLYCHRONIC PENCIL.

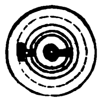
[Registered under the Act for the Protection of Articles of Utility.]

The ever-pointed pencil of our esteemed friend Mr. John I. Hawkins, with which all the world has been long familiar, has been the subject of an infinitude of trivial variations and modifications; but has remained till now much the same in every essential particular, as when it first came from his master-hand. Yet is it by no means the perfect article, which this absence of improvement would seem to indicate; for in the very respect in which it is supposed to be all that can be desired, and from which it has derived its name of "ever-pointed," it is in truth most defective. There is no one who has ever used an "ever-pointed pencil" long, but must have been often annoyed by its *want of point.* At some critical moment when every thing depends upon its not failing you,—as, for example, when making astronomical observations, or timing machinery—you find the pencil exhausted of lead, and even if you have a supply at hand, which is not always the case, before you can replenish the pencil, the occasion for using it is past and gone. All this arises from the want of some contrivance, to indicate to the eye from time to time, the length of unused lead remaining in the pencil. In the pencil of Mr. Horne, of which the annexed engraving, fig. 1 is a sectional view, this defect has, at length, been completely remedied.

Instead of the pencil being filled at the conical end or point only with lead, and that end requiring to be screwed off as often as a new supply of lead is wanted, it has an internal tube filled with lead, which extends the whole way from the top to the point, and is supplied at top by screwing off the head of the case. The lead is pressed forward as required by an external travelling propeller, E; and the length to which that propeller has descended down the case serves as a constant indication of the length of lead remaining unused, so that it must be a person's own fault if he is ever surprised by a want of lead. A, is the internal tube which holds the lead, and B the external tube or case. Both tubes have open slits from the top down to the commencement of the conical point, but on opposite sides; so that when the internal tube is viewed through the slit of the external one, it has the appearance of an entire tube, and the lead is not visible. The

Fig. 1.

Fig. 2.

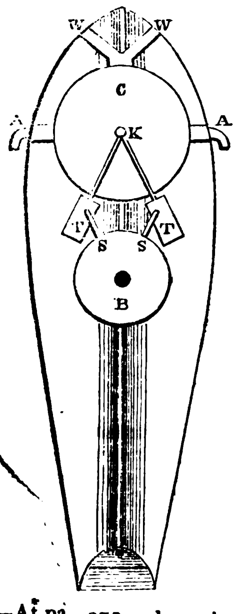


internal tube terminates at top in a circular sliding cap, on the outside of which, there is on one side a small projecting pin, C, which takes into a recess in the inside of the external travelling propeller E, and on the other a spring, from the upper or free end of which there projects another pin, D, which takes into the slit in the inner tube, and rests on the top of the column of lead within,

(overlapping it, as it were.) A plan of the inner sliding cap, and external travelling propeller, is given separately in fig. 2. The external case, A, is screwed on the outside, and the travelling propeller E, which is threaded on the inside to correspond, moves to and fro upon it as it is turned round in either direction. When the propeller is turned from left to right, it carries down with it, through the intervention of the pin D, the sliding cap of the internal tube; and that cap, through the similar intervention of the pin C, presses downward the column of lead. When one column has been exhausted, and another is required to be inserted, the travelling propeller must be turned the reverse way till it reaches quite to the top, when the head is taken off, and access obtained to the lead-holder.

Whether Mr. Horne has thus succeeded in rendering the "Ever-pointed Pencil *perfect*," we will not say; but we must at least freely allow that he has entirely removed the only serious objection we have ever heard made to it.

RUTHVEN'S PROPELLER.



Sir,—At page 376, vol. xxxix. of your Journal, is an account of Walker's proposed method of propelling ships, &c. It appears to be a modification of Burstall's described in a former vol., and has with it, a fault which must occasion the loss of a great amount of the propelling force, namely, the resistance of the surrounding medium (water) to the issuing stream, whilst if the same stream were delivered in the air, the resistance to its exit being greatly reduced, the power gained (as proved by Ruthven's experiments) would astonish any person who had only previously seen that method of propulsion tried under water. Ruthven's is, in my judgment, the best plan on that principle yet proposed.

On the 26th Nov. 1842, I attended a lecture on Ruthven's principle of propelling, delivered by Mr. Lees in the School of Arts (of which Institution he is the lecturer of natural philosophy); on this occasion a spring and toothed wheel small working model, moving in a trough, was exhibited : the power was so trifling, that I and many others went away sceptics, as to any probable utility in the plan.

Mr. Ruthven having faith in the principle, constructed a copper steam working model, 8 ft. 6 in. in length, which I had the gratification of seeing in action in the canal on the 10th June, 1843. Its performance astonished all present, removing doubts as to its utility, thus causing scepticism to evaporate, like damp before a noonday summer's sun. It moved, when unrestrained, at the rate of five miles an hour, and at a much reduced speed towed a boat containing three adult individuals.

Since the above trial (so satisfactory), he has built an iron boat 40 feet in length, which was launched in Leith harbour early in November, 1843; and on the 10th of the same month, I saw it in action at sea off Leith : the trials have been successful.

The following plan and description (from memory) will give your readers an idea of this very ingenious and simple contrivance for propelling ships, &c.

A A, arms through which the water issues, which gives the motive power; they revolve at pleasure. In the plan the position is to propel; when turned forwards, the stream backs; when one is turned backward, and the other forward, the vessel turns; and when downward, the boat stops at once, without stopping the engines.

C, centrifugal pump, which creates a great force of water through the arms.

W W, water-ways to feed the pump; small auger holes through the timbers admit the water to these ways.

B, boilers on the tubular principle; vertical; funnel in the centre.

T T, Twin cylinders, one placed above the other (a new arrangement); four piston rods, connected to the cranks K (on the pump axle), at different angles, give a rapid rotary motion.

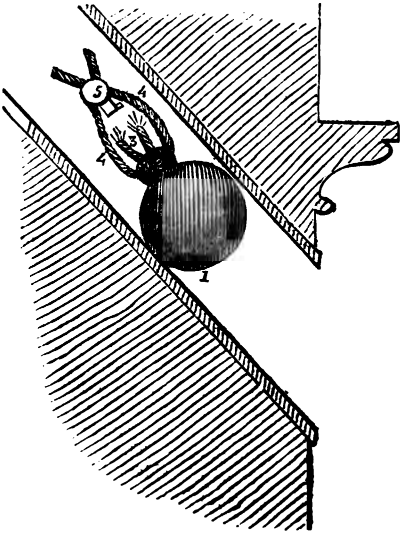
S S, induction steam pipes.

ARTHUR TREVELYAN.

Edinburgh, Jan. 19, 1844.

CAPTAIN NORTON'S SAFE AND EFFICIENT MEANS OF USING HAND GRENADES FOR THE DEFENCE OF PRIVATE DWELLINGS.

"Arma pacis fulcra."



In the days of the Irish rebellion of 1798, the usual mode of attack on the houses of the loyalists, was for a number of banded ruffians to break in the doors at night with sledge hammers; and, judging from recent events, there is too much reason to fear that the practice is still but too much in vogue with the misguided peasantry of the sister kingdom. With the view of protecting individuals from such barbarous visitations, and deterring the murderously inclined from attempting them, our esteemed correspondent, Capt. Norton, has invented the very efficient system of defence represented in the prefixed engraving, and circulated descriptions of it very extensively throughout Ireland.

A is an inclined tube, supposed to be fixed in the wall of a house immediately over the doorway. 1, is a hand grenade fully charged, which is suspended by a loop of twine (4) passing through the cap (2) of the fuze from a nail (5) fixed within the tube. The end (3) of the quick match being lighted, the twine will be almost instantly consumed, when the grenade will descend by its own weight down the tube, into the midst of the storming party. Instead of one such grenade, there may be a whole battery placed overhead. The windows, too, may be protected in the same way as the doors; and a house so protected would be impregnable—for the few hours at least which it would be necessary to stand out, before daylight and assistance arrived.

The fuze may be lighted by a taper or portfire, but Capt. Norton recommends, as the "simplest and readiest way," the application of a lucifer match to the end of the quick match (3) in the same manner as in lighting the wick of a candle.

SCIENTIFIC NECROLOGY.

[From the Annual Report for 1844 of the Council of the Institution of Civil Engineers.]

PROFESSOR WALLACE.

William Wallace, LL.D., Hon. M. Inst. C. E., late Professor of Mathematics in the University of Edinburgh, was born at Dysart, in the county of Fife, in 1768. From birth, fortune, or education, he derived no advantages whatever, and the eminent station he eventually occupied as a mathematician, was achieved solely by his own industry and love of scientific knowledge, aided by natural talents of a high order.

He was appointed, at the age of twenty-six, assistant teacher of mathematics, in the academy of Perth. In 1803 he obtained a professorship in the Royal Military College at Great Marlow (afterwards removed to Sandhurst); and in 1819, upon the death of Mr. Playfair, and the removal of Mr. Leslie to the chair of natural philosophy, he was elected professor of mathematics in the University of Edinburgh.

Professor Wallace's pursuits and studies were chiefly connected with abstract mathematics, but some of the subjects to which he directed his attention may be here noticed, as having more immediate reference to the objects of this Institution.

The Eidograph, an instrument for making reduced copies of drawings, which he invented about the year 1821, and exhibited at a meeting of the Institution in 1839,* is considered superior in many respects to the Pentograph. It possesses greater smoothness and flexibility of motion, and while the copies may be reduced (or enlarged) in any proportion, their similarity to the original is preserved with geometrical precision. By a particular modification, the instrument is made not only to reduce, but to reverse the copies, whereby it is rendered peculiarly applicable to the purposes of the engraver.

Among the papers which he contributed to the "Transactions of the Royal Society of Edinburgh," there is one† on the subject of curves of equilibration, which is interesting to us on account of its connexion with the theory of suspension bridges. From the development of a certain functional equation, he deduces series for computing the co-ordinates of the catenary, and gives tables of the corresponding values of the co-ordinates so computed; thus furnishing engineers with a ready means of constructing arches having the forms of equilibrated curves.

Professor Wallace obtained a high reputation, as a mathematician, at an early age, and during his whole life he laboured assiduously to extend and facilitate the study of his favourite science. Besides his contributions to the memoirs of scientific societies (chiefly the Royal Society of Edinburgh), he was the author of nearly the whole of the articles on pure mathematics in the fourth and subsequent editions of the "Encyclopædia Britannica," and likewise of the greater part of those in Brewster's "Edinburgh Encyclopædia."

His health having given way so far as to render him unable to discharge his duties in the University, he resigned his chair in 1838. During the remainder of his life, although an invalid, his scientific ardour suffered no abatement, for while confined to his chamber, he composed the memoir on equilibrated curves, as well as a work intituled "Geometrical Theorems and Analytical Formulæ," which was published in 1839. His disposition was amiable and benevolent; he was beloved by his friends, and respected by his fellow-citizens; and he died, universally regretted, at Edinburgh, on the 28th of April, 1843, in his seventy-fifth year.

* Minutes of Proceedings, 1839, p. 65.

† Trans. Royal Society Edinburgh, vol. xiv.

MR. BUDDLE.

Mr. John Buddle, M. Inst. C.E., was born at Kyo, near Lanchester, in the county of Durham, in 1773, and resided there nearly twenty years, when he removed to Wallsend with his father, who had then attained considerable eminence as a colliery viewer.

The elder Mr. Buddle was a man of considerable attainments in mathematics; he was a correspondent of Hutton, Emerson, and other eminent men, and contributed many papers to the scientific publications of that period. He was remarkable for the systematic manner in which he conducted his professional avocations; and to him we are indebted for the introduction of iron tubing for sinking shafts, which, it is believed, was first used at the Wallsend colliery.

At an early age Mr. John Buddle evinced an attachment for active occupation, and an eager pursuit of experimental knowledge. These studies and pursuits were encouraged by his father, from whom he derived nearly the whole of his education, having only been at school during one year when very young. He became very early the assistant of his father as a colliery viewer; on one occasion, when, as usual in cases of emergency, the viewers of different collieries were called together, to consult on the means of stopping an extensive fire of gas in the Washington pits, he suggested the trial of a jet of water moved rapidly, alternately, across the flame, in the same manner as in his boyish experi-

ments he had cut off the flame of gas with a knife: the plan was adopted, and being carried into effect by himself, was perfectly successful.

After the death of the elder Mr. Buddle, his son succeeded him in the management of the Wallsend colliery, and there, in 1810, he introduced those extensive improvements in ventilation which have been so much imitated.*

He was engaged as the viewer and consulting engineer of a number of the principal collieries in the North of England. His experience in all the details of the coal trade led to his being frequently examined as a witness in Parliamentary Committees; and he was also employed as consulting engineer on railways and general engineering questions. In 1838 he was appointed one of the Dean Forest Mining Commissioners, and his tact and experience materially aided in the successful completion of their labours. As he advanced in life he became the proprietor of coal-mines, as well as of landed, shipping, and other property, which, under prudent management, produced a considerable income; indeed, when it is remembered that he was a bachelor, and that his habits were very simple, it is surprising that he did not accumulate greater wealth.

He was very liberal, and his charities were extensive. He took great interest in the local scientific societies, and even amidst his numerous engagements, found time to communicate to them some valuable papers.

To all who have visited the coal mines of the North of England, or have taken any interest in the history of coal-mining, the name of Mr. John Buddle is familiar.

He was active, steady, and unremitting in the discharge of duties which were attended at all times with much personal fatigue, and frequently with imminent danger. He was extremely exact in his extensive correspondence, and kept a diary, which may probably furnish materials for a detailed and useful memoir.

In private life he was distinguished by many excellent qualities and social virtues. Among other accomplishments he was a superior musician; and his retentive memory, and happy mode of explaining and illustrating his subject, rendered him as agreeable a companion as he was a valuable friend.

His habits were extremely simple, but his house for nearly half a century was the resort of most of the scientific strangers who visited the North of England, and his hospitality was unbounded. Whether viewed in his professional or private character, he has left solid claims to admiration and esteem, and his death may justly be regarded as a public loss. He died on the 10th of October, 1843, at the age of seventy years, and was interred in the ground which he had given for a cemetery, and where a church had been erected, on his estate at Benwell, near Newcastle.

* The Museum of Economic Geology, Craig's Court, contains a model which exemplifies this system of ventilation.

MR. PENN.

Mr. John Penn, M. Inst. C.E., was born near Taunton, in Somersetshire, in the year 1770, and was apprenticed to a millwright at Bridgewater, whence he travelled to Bristol, and worked there as an operative; he soon became the foreman of an important work, when only twenty-two years of age, and was celebrated for his theoretical and practical knowledge of the forms of the teeth of wheels, which branch of instruction was, at that period, only imperfectly understood by mechanics. He removed to London about the year 1793, and after working at and being a foreman in several works, he commenced business on his own account in 1801.

His attention was at first chiefly directed to the construction of flour-mills, in which he made many improvements, particularly in the substitution of metal, for wood framing. In consequence of the injudicious proceedings of the Millwrights' Union, he was induced to oppose a determined resistance to their demands, and by the introduction of self-acting tools, and the instructions given by him to another class of workmen, the millwrights lost many of the privileges they had previously enjoyed.

The tread-mills for prisons* were first constructed at Mr. Penn's works, and latterly he (in conjunction with his son) manufactured many marine engines, particularly those with oscillating cylinders.†

Mr. Penn was well versed in general science; he was an amateur astronomer, and possessed some valuable instruments; much of his leisure time was devoted to horticultural pursuits, which led to several improvements in the methods of heating conservatories and forcing houses.

He died suddenly on the 6th June, 1843, in the 73rd year of his age, having enjoyed for many years the confidence and esteem of a large circle of friends.

MR. AHER.

Mr. David Aher, M. Inst. C.E., was born in the year 1780; he attained very early a proficiency in physical science, and at fifteen years of age commenced his studies as a civil engineer.

* Designed by Mr. William Cubitt, V.P. in 1818.
† First patented by Mr. Aaron Manby, in 1816.

In 1803 he surveyed and superintended several of the works of the Grand Canal Company, (Ireland,) and subsequently directed the collieries in the County Kilkenny and Queen's County, an occupation for which he was well suited from his knowledge of geology, a science at that time but little cultivated in Ireland. By his judicious direction of borings, and other trials, discoveries were made which have proved very valuable to the neighbouring coal proprietors. His inventions and improvements in mining and boring machinery, (which have been generally adopted,) are remarkable for the mechanical ingenuity displayed in them, for the simplicity of their construction, and for their practical utility.

In the years 1810, 1811, and 1812, he was engaged in making experiments and reports for the commissioners appointed by Government to enquire into the nature and extent of the "Bogs in Ireland, and their capability of being made available for cultivation or other purposes."

While engaged in the direction of the collieries, he laid out nearly all the new lines of road which have been made through the County Kilkenny and neighbourhood, and also the Great Leinster and Munster Railway, from Dublin to Cork, by Kilkenny, Clonmel, Cahir, &c.

In 1840 he met with some disappointments and losses, which weighed heavily on his mind, and were the principal cause of the illness which terminated his life. He died in the 62nd year of his age, respected for his high professional attainments and strict integrity of character, and regretted by all who knew him.

MR. RANSON.

Mr. Robert Gill Ranson, Assoc. Inst. C.E., was a manufacturer of paper at Ipswich; in 1840 he introduced an improved mode of sizing and drying machine-made paper, substituting for the ordinary tedious process of tub-sizing (in which it was requisite that the paper should be previously cut into sheets) a method by which he was enabled to size and dry writing or drawing papers, in the lengths made by Fourdrinier's machine; by this process the time occupied in the manufacture was reduced, and the uncertainty of the effect of the weather in drying was avoided.

In consequence of a long illness preceding his decease, this invention was not extensively carried out, but it appears now probable that it will be generally adopted.

Mr. Ranson only became an Associate of the Institution in 1842, but he demonstrated the interest he felt in its welfare, by exhibiting at the President's conversazione a sheet of drawing paper 400 feet in length, which had been completed by his process from the state of rags, in the short space of 48 hours.

He was highly respected by his friends, and his decease, at the age of fifty-one years, was much regretted.

ON THE PROCESS OF PRINTING WARPS TO PRODUCE THE FABRICS TERMED "CLOUDED," OR "CHINÉ." BY G. T. KEMP, ESQ.

(From the Society of the Transactions of Arts.)

The art of clouding silk has been practised upwards of a century, but until lately was conducted in a very rude manner, and at a very considerable cost.

The technical term to "cloud," or, as in French, "chiner," denotes the partial colouring of the threads of silk, or other material, previously to their being woven; producing an irregular speckled appearance, or assuming a more definite design at the will of the operator, but always characterised by a softened, shaded, or irregular outline.

In 1839 a process, then in active operation at Lyons, was introduced into this country by Mr. Kemp, which afterwards proved to be nearly identical with that described in Mr. Wilson's patent, taken out in 1825. In 1840 and following years, the process was very generally applied to manufactures of broad silks, ribands, shawls, and other articles of silk, as also to mixed fabrics of cotton, linen, or wool.

The process is as follows. The warp, or "cane," generally of white, is "turned on," and "twisted in" in the ordinary manner for introduction to a common loom, provided with a harness of the width and richness of the work to be manufactured. The "porry," or surface of silk stretched or exposed in the loom, is then carefully "picked," or cleared, from rough or hairy threads, and other imperfections. A firm heading, or "tab," about two inches in width, is first woven, after which a small rod is introduced in the shed, for the purpose of attaching the warp to the "cloth beam." "Cross-strings" are then woven in, to enable the workman to twist the warp in with facility after being printed. The weaver next proceeds to draw about 12 inches of the cane through the harness, and weaves a strip of plain cloth, containing about 60 shoots in ¾ of an inch. After winding about 12 inches of the warp on the cloth beam, he repeats the strip of plain cloth, continuing the process, picking or clearing the cane throughout, until the whole warp has been thus prepared, the end of which he secures with a firm heading, as at the beginning. The shoot best fitted to weave in the strips of plain cloth is Italian

singles, 12 or 14 deniers in size, with the usual Organzine spin. This silk should be boiled off, allowing by its fineness the colouring matter to penetrate the warp in printing. If a fine and delicate pattern is required, the interval of 12 inches cannot be exceeded with safety; but when the pattern is large, and the outline irregular, a longer space may be left between the strips. The cloth-beam, which needs not be more than 3 inches in diameter, requires a ring or flange of wood or cast-iron, to be fixed at each end of the warp, to support the sides when it begins to rise on the beam or roll. The frequent introduction of a set of smooth laths strung together, and encompassing, or casing the beam, and wound on with the warp, are found to answer the same purpose as the flanges. It is important here to remark that the warping and turning-on should be performed in the best manner, and the picking, or clearing the cane very carefully watched, as it is obvious that mending any threads *after* the printing must inevitably mark the work.

The object of forming the temporary fabric just described is to keep the threads of the warp in their proper positions during the subsequent operations of printing, steaming, washing, drying, and weaving, so as to preserve the pattern when woven.

The cloth beam with the warp thereon being delivered to the printer, he fixes it in a frame, in which it is supported horizontally on its axis, he then draws off a sufficient length of the partially woven warp, which is passed over the printing table, at the end of which it is attached to two parallel lengths of tape, about 15 yards long, which pass over a series of rollers to an empty beam, which may be termed the printer's beam, to which they are attached, and which is placed near to and *above* the cloth beam, so as to enable the printer at the same time to let off the necessary length of warp from the cloth beam, and wind a corresponding length on to the printer's beam as the printing of the warp proceeds.

When extended over the table the warp is printed with blocks, in the ordinary manner as used by calico-printers, being kept close down to the surface of the table by means of a roller at each end, under which the warp passes, and which rollers are capable of being raised or depressed as circumstances require. The printing table is covered with a blanket surmounted with an oiled or painted cover, between which and the warp a piece of calico is spread, of which a fresh length must be substituted every time a table-length of the warp has been printed. The neglect of this would cause superfluous colour received by the calico to smear the warp.

Each table-length of warp, when printed, is liberated from the table by raising the movable rollers, and is then drawn by the tapes over the series of rollers to the printer's beam, on which it is wound. During this passage of about 15 yards in length (as before stated), a sufficient opportunity is given for *drying* the colouring matter on the warp, so as to prevent any smearing or marking off when rolled on the printer's beam. To assist the drying, a certain degree of artificial heat with good ventilation is maintained.

The warp, thus printed, is wound off the printer's beam and formed into a large skein of from 8 to 10 feet in circumference, and next undergoes the operation of *steaming* to fix the colouring matter, great care being taken to prevent any condensation of moisture on the silk.

It is then thoroughly washed in a stream of cold water, to remove the extraneous colouring matter, and also the *thickening* ingredients with which the colour is mixed. During washing, the silk is protected by a covering of loose canvas in which it is sown up.

After drying, which is most advantageously effected without artificial heat if the weather is favourable, the warp is given to the weaver to be rewoven into the ultimate figured cloth required.

In winding the warp again on the weaver's beam, the ordinary means of spreading it, by passing it through a coarse reed or wraithe, are inapplicable, on account of the strips of cloth which have been woven across it; the process, however, is readily effected by stretching these strips to their full extent by hand, and thus guiding it on to the beam or roll. The weaver pursues the ordinary method of manufacturing the piece of goods, drawing out as he proceeds in weaving the weft which has been woven in, to form the small strips of cloth before mentioned. No subsequent finish or dressing is required, and the work is ready for sale when it leaves the loom.

ELECTRO-METALLURGY IN FRANCE — MESSRS. ELKINGTON AND CO.'S PATENTS.

The newspapers announce that the *Cour de la Première Instance* of Paris have "pronounced judgment confirming the patents taken out in France by Messrs. Elkington and Co. and Count de Ruolz, for the electro-process of depositing the various metals." We extract the following particulars explanatory of those proceedings, and of Comte de Ruolz's share in the honour of introduci

electro-metallurgy into France — from a pamphlet "On the Application of Electro-metallurgy to the Arts," just published by Messrs. Elkington and Co.

"In 1836 we obtained patents in England, France, and some other countries, for gilding metals by means of a solution of gold, the process being effected by dissolving the oxide of gold in bicarbonate of potash. Upon introducing copper articles into this preparation in a boiling state, an interchange of elements took place, a portion of the copper became dissolved by the action of the potash, and an equivalent of gold was deposited upon the surface of the copper article; this, it will be observed, was effected without the employment of any electrical apparatus, but it served as an introduction to the more important application of the battery processes. For while Spencer, De la Rivė, of Geneva, and other philosophers, were endeavouring to effect the application of gold and silver as a coating to metallic surfaces, employing the nitro-muriatic solution of the former, and the nitric solution of the latter, we, by our previous experience, were led to experiment with the alkaline solutions of these metals, and were thus successful; whereas the acid solutions oxidizing the surface of the articles, no permanent coating could be effected.

"The patents granted us in 1836 and 1840 have been extensively infringed, and considerable litigation has followed; the former has been for five years before the different judicial courts in France, and it was only in July last that the *Cour Royale* finally confirmed our patent. The one of 1840 is now undergoing the same ordeal.*

"It is gratifying to us, however, that the two most important Societies of Paris, in connexion with the arts, viz., the 'Académie des Sciences,' and the 'Societé d'Encouragement,' have appreciated our patents; the former has awarded us a prize of 6,000 francs, and the latter the gold medal of the Society.

"We cannot account for the feeling which has prompted the editors of some of our periodicals to accord to France the most important features of these applications, to the prejudice of the ingenuity of our own country. We have hitherto passed these unnoticed, being guilty of working for profit more than fame. The facts, however, are as follows:—In September, 1840, we obtained a patent of improvement upon our original patent of 1836, for the use of the battery and the alkaline solutions of gold and silver, and lodged at that time (as bound by the law in France) a specification of the process; nine months after, and six months after the English specification had been published, a patent was taken in Paris by Count de Ruolz for the same processes, and for the same solutions: certainly some others were described, and the application of other metals was embraced, as cobalt, nickel, &c. In consequence of the extended litigation we had experienced with our former patent, we had done little more, at the beginning of 1841, than exhibit the process and produce specimens of our electro-gilding to some of the members of the Royal Institute. Meanwhile, the Count and his friends had written a great deal, and had partly completed extensive arrangements to work the process itself. No doubt we should have established our precedence, but one suit in a foreign country of nearly five years' duration was little encouragement to that course; and having been strongly advised by some members of the Royal Institute to effect a union of the patents, we at once negotiated terms; and it was highly gratifying to us that, by the adoption of nearly every detail of our processes, our (now) friends admitted their superiority to their own. There are at present two establishments in Paris, extensively occupied in carrying out these processes."

* It is this, we presume, which has been just confirmed.—ED. M. M.

MR. MOAT'S COMMON ROAD ACCELERATOR.

Sir,—Your correspondent, "S. P. B.," by his remark in your last Number, that a one-horse machine on my plan would not take up more than the ordinary width of road, clearly intimates the objection to two horses being that way used, because they would take up more than the ordinary room for other vehicles. Now I can only say, that the "Accelerator" which I built for two horses, did *not* take up more than the ordinary width of road, and that I limited myself in width to that of an omnibus. All my expectations were verified, but I found that horses required more time for training than I had to devote to the purpose; therefore I have not since done any thing more in the affair.

If any of your readers would like to carry out my views, and will communicate with me, the patent shall be at their service.

I am, Sir, your most obedient,

WM. C. MOAT.

28, Upper Berkeley-street, Feb. 5, 1844.

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Edited by J. C. Robertson, No. 166, Fleet-street.

COWAN'S GAS-METER DRUM.

Fig. 1.

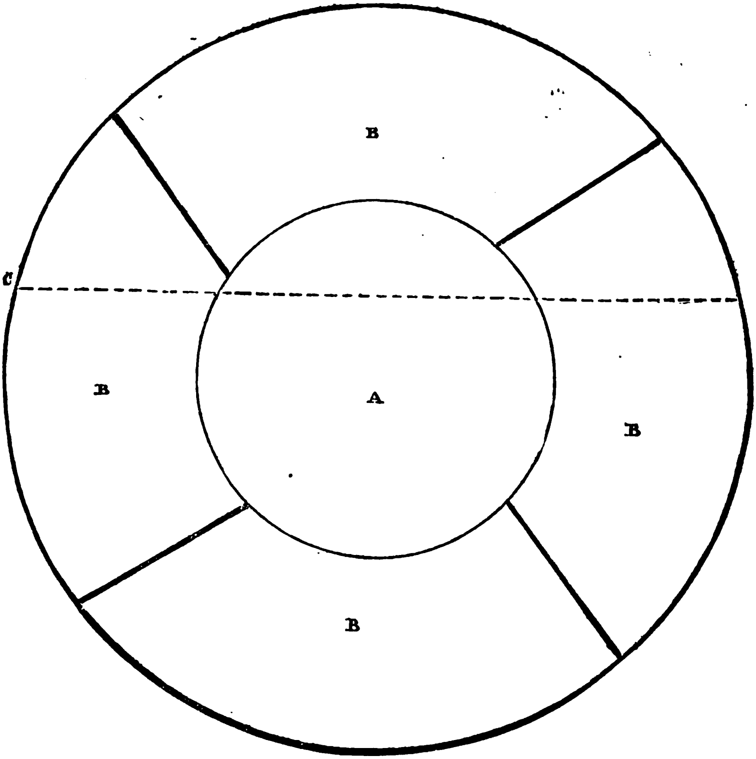
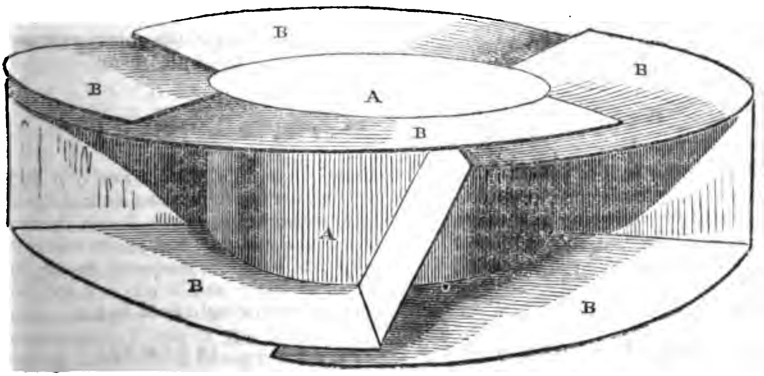


Fig. 2.



IMPROVED DRUM FOR GAS-METERS. MR. WM. COWAN, OF GLASGOW, GAS-METER MANUFACTURER, PROPRIETOR.

[Registered under the Act for the Protection of Articles of Utility.]

FIG. 1 is a side elevation of this drum; and fig. 2 a perspective view, with the rim or covering of the periphery removed, so as to exhibit an interior view of the same.

A is a solid or air-tight cylinder, and B B B B, four gas chambers surrounding, or concentric with A, which are constructed in the same way as in the common gas-meter, to allow of the entrance and escape of the gas from each, as the drum revolves. The dotted line C represents the height to which the water rises, which is the same as in the common meter; but it will be observed that as each of the chambers, B, rises to the top of the drum, it is entirely separated by the inner cylinder, A, from the water, which cannot therefore interfere in the least with the exact performance of the apparatus; whereas in the common wet gas-meter there is always a portion more or less of each chamber immersed in the water, and that an *uncertain* portion which makes the measurement proportionally defective.

The inventor of this new drum, who is himself a manufacturer in a large way of business, has had it for some time in actual use, and he assures us that it is perfect in its action. "The gas," he says, "is now measured with as much precision and accuracy as wine or spirits by the standard measures in use." If this be the case—and we see at present no reason to doubt the correctness of Mr. Cowan's statement—he must be allowed to have accomplished a most important and long-sought-for object, by exceedingly simple means.

PROBLEMS ON STEAM POWER. BY MR. THOMAS TATE, MATHEMATICAL MASTER OF THE NORMAL SCHOOL, BATTERSEA.

Sir,—For the sake of those unacquainted with the higher branches of mathematics, the investigations, of the following useful mechanical problems are conducted on purely algebraic principles. It is true, that the application of the integral calculus will in some cases bring out more concise results, but surely in the absence of a knowledge of that department of mathematics, it is desirable that the practical man should perform his calculations by a method which he can appreciate, rather than be blindly led by a rule derived from principles too subtile for his comprehension.

Few rules in mensuration are of more extensive utility, than Thomas Simpson's formula for finding the area of an irregular curved space; in addition to its ordinary applications J. V. Poncelet has shown that it may be eligibly employed for finding the work done by expansive vapour. The following is an easy demonstration of this valuable rule. (See fig. 1, next page.)

Let $a\,b\,f\,j\,i$, &c., be a space bounded by the curve, $b\,d\,f\,h\,j$, &c., on one side, and let $b\,a$, $d\,c$, $f\,e$, $h\,g$, &c., be any odd number of equidistant ordinates. Put D for the common distance between these ordinates, P for the first ordinate, P_1 for the second, P_2 for the third, and so on to P_n for the $(n+1)$th, then,

The area, of the curved space

$$= \frac{D}{3}\left\{ P+P_n+4\,(P_1+P_3+P_5+\ldots)+2\,(P_2+P_4+P_6+\ldots) \right\}$$

That is, the area is equal to the third of the common distance, multiplied by the sum of the following quantities, viz., the sum of the extreme ordinates, four times the sum of the even ordinates, and twice the sum of the odd ordinates.

Proof. Take $c\,m = c\,q = \frac{1}{3}\,a\,c$, and draw the ordinates $m\,n$ and $q\,p$ intersecting the curve in the points n and p; and let right lines be drawn between b and n, n and p, p and f, observing that $n\,p$ intersects $c\,d$ produced in the point o: then, $a\,m = m\,q = q\,e = \frac{2}{3}\,a\,c$; and, The area of the right lined figure

$$a\,b\,n\,p\,f\,e = a\,b\,n\,m + m\,n\,p\,q + q\,p\,f\,e = \frac{a\,m}{2}\,(a\,b+m\,n)+$$

$$\frac{mq}{2}(mn+qp)+\frac{qe}{2}(qp+ef)=\frac{ac}{3}(ab+2mn+2qp+ef)=$$

$$\frac{ac}{3}(ab+4co+ef),\ \text{because } nm+pq=2co.$$

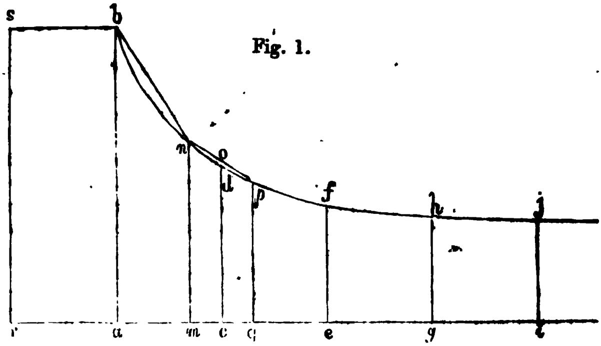


Fig. 1.

Now this area is evidently greater than the area of the curved space, when the curve is convex to the axis, and less when concave; in order therefore to give us a nearer approximation to the true area, we may use $c\,d$ in the place of $c\,o$; hence, when $a\,m$ is small compared with $a\,b$, we have very nearly,

$$a\,b\,d\,f\,e=\frac{D}{3}(P+4P_1+P_2)$$

Similarly,

$$f\,e\,g\,h\,j\,i=\frac{D}{3}(P_2+4P_3+P_4),$$

$$j\,i\ \&c.=\frac{D}{3}(P_4+4P_5+P_6),$$

adding these equalities, the area of the curved space, containing six divisions, will be expressed by,

$$\frac{D}{3}\left\{P+P_6+4(P_1+P_3+P_5)+2(P_2+P_4)\right\}$$

and so on to other cases.

Generally, it may be shown, that if the proposition be true for n divisions in the axis, it will also be true for $n+1$ divisions.

We proceed now to show how this formula may be used for determining the work done by steam acting expansively. In the annexed figure, $o\,i$ represents the cylinder of a steam-engine; a, the point in the stroke at which the steam is cut off; $a\,c$, $c\,e$, $e\,g$, &c., any even number of equal spaces into which the remaining part of the stroke is divided; $r\,s$ or $a\,b$ in fig. 1 = the units in the pressure, P lbs. of the steam acting upon 1 inch of the piston through the space $r\,a$; the ordinate $c\,d$ = the units in the pressure upon the piston at c; the ordinate $e\,f$ = the units in the pressure upon the piston at e; and so on. Then, the area of the figure $r\,s\,b\,a$ = the units of work performed upon 1 inch of the piston whilst moving from r to a, because the units of

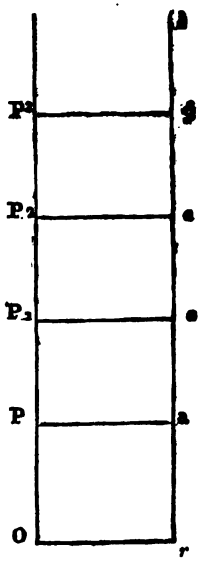


Fig. 2.

work $= P \times r a$; the area of the curved space $a b d c$ = the units of work performed upon the piston from a to c, because the units of work, in this case, approximate to $\frac{P + P_1}{2} \times a c$, i.e., to the area of $a b d c$; and so on to the other spaces; so, therefore,

The units of work performed upon 1 inch of the piston in one stroke =

$$\frac{D}{3}\left\{P + P_n + 4(P_1 + P_3 + P_5 + \ldots) + 2(P_2 + P_4 + \ldots)\right\} + P \times r a;$$

where the remaining part of the stroke is supposed to be divided into n even intervals, P_1, P_2, P_3, &c., are the pressures at the end of the 1st, 2nd, 3rd, &c., intervals respectively.

Eaxmple 1. Steam is admitted into the cylinder of a steam-engine at an effective pressure of 28 lbs. per square inch, the length of the stroke is 9 feet, and the steam is cut off at 3 feet of the stroke; required the units of work performed upon 1 inch of the piston in one stroke.

Here the steam acts expansively over 6 feet of the stroke; this space, therefore, will be most conveniently divided into six equal parts, or intervals, for then the distance between each ordinate or interval will be 1 foot. In order to find the elasticity of the steam at these intervals, we have by Marriotte's law for elastic fluids,

The elasticity at any new volume = $\dfrac{\text{original vol.} \times \text{pressure at that vol.}}{\text{new vol.}}$

Whence, $P_1 = \frac{3 \times 28}{4} = 21$; $P_2 = \frac{3 \times 28}{5} = \frac{84}{5}$; $P_3 = \frac{3 \times 28}{6} = 14$; $P_4 = 12$;

$P_5 = \frac{42}{4}$; $P_6 = \frac{28}{3}$; then by the rule just established, The units of work in one stroke

$$= \frac{1}{3}\left\{28 + \frac{28}{3} + 4\left(21 + 14 + \frac{42}{4}\right) + 2\left(\frac{84}{5} + 12\right)\right\} + 3 \times 28 = 176 \cdot 3.$$

To determine general expressions for the horse power, &c., of an engine.

For this purpose let,

H = the length of the stroke after the steam begins to work expansively.
h = the point of the stroke at which the steam is cut off, including the clearance c.
m = the number of equal parts into which the remaining part of the stroke is divided.
p = the resistance of the vapour in the condenser.
U = the units of work performed by the steam on 1 inch of the piston in a single stroke.
N = the number of strokes performed in 1′.
K = the area of the piston.
H. P = horse powers of the engine.
L = the load on each square inch of the piston.
V = the velocity at any height of the stroke H_1.
U_1 = the units of work performed by the steam on 1 inch of the piston through H_1 of the stroke.
U_2 = the units of work in the load at the same height of the stroke.
w = the whole mass in lbs. moved by the engine.

1. *To find the Pressure at any interval of the Stroke.*

The distance between each interval $= \frac{H}{m}$ ∴ the vol. of the steam at the end of the

nth division $= K\left(h + \frac{n H}{m}\right) = \frac{m h + n H}{m} \cdot K$; ∴ by Marriotte's law,

$$P_n = \frac{h K P}{\frac{m h + n H}{m} \cdot K} = \frac{m h P}{m h + n H};$$ from which all the pressures are determined:

for example, $P = \dfrac{m h P}{m h + 2 H}$

2. *To find* U.

The work performed before the steam is cut off $= P(h-c)$; ditto by the vapour in the condenser in one stroke $= p(H + h - c)$

$$\therefore U = \frac{H}{3m}\left\{P + P_m + 4(P_1 + P_3 + \ldots) + 2(P_2 + P_4 + \ldots\right\} + P(h-c) - p(H+h-c)$$

3. *To find* H. P.

The work done upon the whole piston in $1' = NKU$, $\therefore HP = \frac{NKU}{33000}$

4. *To find* L.

The units of work in the load in one stroke $= L(H + h - c)$. But this must be equal to the work performed by the steam in one stroke—

$\therefore L(H+h-c) = U$, and $L = \frac{U}{H + h - c}$

5. *To find* U_1.

Here it is only necessary to put H_1 for in the expressions 1 and 2.

6. *To find* U_2.

$U_2 = L(H_1 + h - c)$, or by eliminating $U_2 = \frac{H_1 + h - c}{H + h - c} U$.

7. *To find* V.

The work in a moving body is expressed by the formula,

$$U = \frac{V^2 W}{2g}; \therefore V = \left(\frac{2gU}{W}\right)^{\frac{1}{2}}$$

Professor Moseley gives a very simple demonstration of this formula in his "Mechanics for Engineers." In justice to this distinguished mathematician and philosopher it may be proper to observe, that he was the first in this country to give a comprehensive view of the subject of *work*.

The work remaining in the engine when the piston has arrived at H_1 = the work done by the steam, minus the work done upon the load $= K(U_1 - U_2)$. Substituting this for U in the general expression for V we have

$$V = \left(\frac{2gK(U_1 - U_2)}{W}\right)^{\frac{1}{2}}$$

8. *To find the maximum velocity of the piston.*

In order to effect this we must first find the height at which this velocity takes place. Now this point must be where the accelerating force moving the piston becomes nothing, *i. e.*, where the load is equal to the pressure of the steam, whence by Marriotte's law,

$$L = \frac{hP}{H_1 + h}; \therefore H_1 = \frac{hP}{L} - h;$$

or $H_1 + h = \frac{hP}{L}$, which is the distance of the point measured from the bottom of the cylinder. This value for H_1 substituted in the expression for V, will give the maximum velocity.

Example 2.—Let the area of the piston = 4,000 inches, the length of the stroke = 9 feet, the number of strokes per minute = 12, the elasticity of the steam = 30 lbs., that of the vapour in the condenser = 2 lbs.; and suppose the steam to be cut off at 3 feet of the stroke; required, 1st, the horse-powers of the engine; 2nd, the load; 3rd, the point at which the velocity of the piston is a maximum.

In this example $H = 6$, $h = 3$, let the remaining part of the stroke be divided into 6 equal parts, *i. e.*, let $m = 6$, then the distance between the ordinates of pressure will be 1 foot, then by 1,

$$P_n = \frac{6 \times 3 \times 30}{6 \times 3 + n \times 6} = \frac{90}{3+n}; \text{ hence,}$$

$$P_1 = \frac{90}{4}; P_2 = \frac{90}{5} = 18; P_3 = \frac{90}{6} = 15; P_4 = \frac{90}{7}; P_5 = \frac{90}{8} = \frac{45}{4};$$

$$\text{and } P_6 = \frac{90}{9} = 10; \text{ then, } P_1 + P_3 + P_5 = \frac{90}{4} + 15 + \frac{45}{4} = \frac{195}{4};$$

$$P_2 + P_4 = 18 + \frac{90}{7} = \frac{216}{7}; \text{ therefore, by 2,}$$

$$U = \frac{1}{3}\left\}30 + 10 + 4 \times \frac{195}{4} + 2 \times \frac{216}{7}\right\} + 30 \times 3 - 2 \times 9 = 170{\cdot}904;$$

$$\text{Again, by 3, } H.P = \frac{12 \times 4000 \times 170{\cdot}904}{33000} = 248{\cdot}5;$$

$$\text{By 4,}\quad L = \frac{170\cdot9}{9} = 18\cdot98 \text{ lbs.}$$

$$\text{By 8,}\quad H_1 = \frac{3 \times 30}{18\cdot98} - 3 = 1\cdot74 \text{ feet; and } H_1 + h = 4\cdot74.$$

Example 3.—If the mass moved in the last example = 400,000 lbs., what will be the velocity of the piston at 5 ft. of the stroke? or where the maximum velocity nearly takes place?

Here we shall suppose the space over which the steam acts expansively, to be divided into four equal parts, then the common distance will be $\frac{1}{2}$, and

$$\therefore P_1 = \frac{3\cdot30}{3\frac{1}{2}} = \frac{180}{7};\ P_2 = \frac{45}{2};\ P_3 = 20;\ P_4 = 18;\ \text{then,}$$

$$\text{By 5,}\quad U_1 = \frac{\frac{1}{2}}{3}\left\{30 + 18 + 4\left(\frac{180}{7} + 20\right) + 2 \times \frac{45}{2}\right\} + 30 \times 3 - 2 \times 5 = 125\cdot9;$$

$$\text{By 6,}\quad U_2 = 18\cdot98 \times 5 = 94\cdot9;\ \text{and, finally,}$$

$$\text{By 7,}\quad V = \left(\frac{2 \times 32 \times 4000 \times 31}{400000}\right)^{\frac{1}{2}} = 4\cdot4 \text{ ft. per } 1''.$$

In this calculation 32 is put for g.

In the preceding investigations it has been presumed that Marriotte's law correctly expresses the relation of pressure and volume of elastic vapour; but we know that this can only be the case when the steam is maintained at the same temperature throughout the whole of the stroke of the piston. Now the fact is, the temperature of the steam decreases as its volume is increased, so that the pressures determined by Marriotte's law will be rather greater than the true pressures. Pambour has shown that the steam in the cylinder is always in the condition of maximum density, and that therefore the steam there observes the same relation of pressure and volume that it does when in contact with the fluid from which it is raised. The following empirical formula, due to Mr. Pole, gives, even in extreme cases, a very near approximation to the true relation as determined by experiment:

$$v = \frac{n}{P} + m,$$

where P is the pressure of the steam corresponding to v volume expressed in units of the water, $n = 24250$, and $m = 65$.

In order to adapt this formula to the preceding expressions, let S = the volume of the water, and M its volume in the form of steam, then

$$v\,S = M, \therefore v = \frac{M}{S},$$

substituting this new value of v,

$$\frac{M}{S} = \frac{n}{P} + m,$$

let the volume of the steam become M_1, and let P_1 be the corresponding pressure, then we have also,

$$\frac{M_1}{S} = \frac{n}{P_1} + m.$$

Eliminating S by division,

$$\frac{M_1}{M} = \left(\frac{n}{P_1} + m\right) \div \left(\frac{n}{P} + m\right).$$

Solving this expression for P_1, we have,

$$P_1 = \frac{1}{+\frac{M_1}{M}\left(\frac{1}{P} + \frac{m}{n}\right) - \frac{m}{n}}.$$

Let us now put h for the height of the stroke corresponding to M vol., and h_1, for the height corresponding to M_1 vol.; then

$$\frac{M_1}{M} = \frac{Kh_1}{Kh} = \frac{h_1}{h},$$

then by substitution and working out the value of $\frac{m}{n}$, we have,

$$P_1 = \frac{1}{\frac{h_1}{h}\left(\frac{1}{P} + \cdot00268\right) - \cdot00268}.$$

After the manner of (1) for P_1 put P_n, and therefore, for h_1 put $h + \frac{n\,H}{m}$; then we finally have,

$$P_n = \frac{1}{\left(1 \quad \frac{n\,H}{m\,h}\right)\left(\frac{1}{P} + \cdot00268\right) - \cdot00268}.$$

This value of the pressures, when great accuracy is required, may now be used in the formula 2.

Ex. 4. Steam is admitted into the cylinder at a pressure of 30 lbs. per square inch; the length of the stroke is 10 feet; the steam is cut off at 2 feet of the stroke; the elasticity of the vapour in the condenser is 2 lbs., required the units of work done upon 1 inch of the piston in one stroke.

Let that part of the stroke over which the steam acts expansively be divided into four equal parts, then in this case, $m=4$, $h=2$, $H=8$, $P=30$; therefore,

$$P_1 = \frac{1}{2\left(\frac{1}{30} + \cdot00268\right) - \cdot00268} = 14\cdot4 \text{ lbs};$$

$P_2 = 9\cdot4$; $P_3 = 7\cdot07$; $P_4 = 5\cdot6$.

Substituting these in formula 2, we obtain $U = 133$ nearly. Whereas, by Marriotte's law it will be found that $U = 137$ nearly.

(*To be continued.*)

THE SOCIETY OF ARTS.

Sir,—In a review of the Transactions of the Society of Arts, for the sessions 1841-2, 1842-3, in the Number of your Journal for the 20th ult., the writer makes some remarks upon the late depressed condition of the Society of Arts, and the causes of its present prosperity, which, although correct in their general outline, are, in some particulars, so much the reverse, as to be calculated to lead those of your readers who are not acquainted with the real facts, to a most unjust inference, and to prove to those who *are* so acquainted, that he has been misinformed upon them.

The writer says, "Some three years ago it was generally considered as *in articulo mortis;* its volume of Annual Transactions, once of a very respectable bulk, had dwindled to a skeleton thinness; its exchequer was almost empty; its sittings deserted; its members greatly diminished in numbers, and wholly bereft (to all appearance) of zeal or care for the Institution; and its reputation with the public was down to zero. But since then (we pass over one change in the management which advanced matters only from bad to worse) the Society has had a new president (Prince Albert), several new heads of departments, and a new secretary (Mr. Whishaw); and since then it has also adopted a new system of action—opening its doors to useful inventions and improvements of every class and degree, instead of rigidly excluding, as heretofore, all that had the stamp of 'patent' upon them."

The first portion of this statement is so far correct that it would appear vexatious to oppugn it upon any point. But what inference is to be drawn from the words, "But since then," in connexion with what follows? and what is the meaning of that mysterious parenthesis? Why, according to the ordinary process of reasoning, the inference is, that Prince Albert and the new secretary are the originators of the Society's present prosperity, and that all the improvements in its management and practice have been introduced since their accession to office. It is most probable, indeed, that the name of His Royal Highness has done something for the Society, and that the activity of the new secretary has done more; but we must look back to an anterior period to see who it was that undertook the labour of attacking and breaking through inveterate prejudice, of struggling with and overcoming the repugnance of the patient to the only medicine that could save life, and that, too, at the risk of getting a few kicks in the struggle.

I am generally averse to obtruding myself upon public notice, especially when for the purpose of proclaiming my own merits; but I have observed, Sir, that in such cases as the present a man may carry his reserve to such extremes as to become, by silence, most culpably unjust to himself. I must, therefore, plainly state that *all* the recent improvements, as they *now* exist, in the Society of Arts were introduced while I was secretary to that Institution, and that they resulted from my exertions; and further, that, but for those exertions, *the Society would now be extinct.* It is very well known to those who took any part in the management of the Society at that period, that the small interest of the meetings, and the falling off in the number of members, were subjects of constant conversation between myself and the working members, and that I constantly urged upon them the necessity of introducing improvements (such as were afterwards adopted) in order to restore the Society to its former eminence; and to this limit I confined the exercise of my influence, because, as a general rule, I considered the direct interference of a secretary as objectionable, from its tendency to the formation of party. But when matters came to a crisis—when I was told, at a meeting of a Committee, in November, 184

that the Society could not possibly hold out any longer, and that preparations must be made for closing it at the end of the year, I considered that I had full warrant to overstep the ordinary bounds; and accordingly I commenced an active personal canvass of those members whose views coincided with my own, and succeeded in persuading a considerable number to take up the business in earnest. A special Committee was appointed, and sent in an excellent report to the Society, in which the causes of its decay were pointed out, and certain measures were recommended as the means of its regeneration. Although one very important recommendation of that Report was rejected, the rest were, for the most part, shortly afterwards adopted, and the effect produced by their working, proved the correctness of my views. During the last three months of that session, the number of members elected exceeded the whole number elected during the preceding two sessions, and the meetings of the Society were numerously attended. It appears, from the number of members elected at the opening of the following session, and from the papers read at the meetings, that the public interest in the Society continued rapidly to increase. When I resigned my office, therefore, I had, at least, the gratification of leaving the new system fairly at work; and it is now an additional source of gratification to have the opportunity of giving to the present secretary his full share of credit for the spirited manner in which he has followed out the intention of the new regulations.

I trust, Sir, that you will take this statement as one of simple *facts*, produced for the purpose of dispelling a notion that would, I think, too readily arise from the words I have quoted from your journal, viz., that there existed some obstacle to the prosperity of the Society which could only be removed by the appointment of a new secretary. These facts claim nothing more for me than what I desire—the credit of having conscientiously discharged my duty; and I trust that you, at least, will not, by withholding an act of justice, compel me to ejaculate, "*Sic vos non vobis*," &c.

I am, Sir, your most obedient servant,

W. A. GRAHAM.

21, Alfred-street, Bow-road, Feb. 7, 1844.

[We are grateful for the opportunity which Mr. Graham has afforded us, of making amends for the injustice of the remarks on which he animadverts in so temperate and gentlemanly a spirit. We do not pretend to deny that they had the meaning which he ascribes to them; they were founded on information which we believed to be correct, but now find to have been most erroneous; and having been unconsciously the instruments of a grievous wrong, it is a great consolation to us to be able so soon to set Mr. Graham and ourselves right with the public. 'nce the receipt of Mr. Graham's letter we have ıde enquiries of others *necessarily familiar with the real facts of the case*, and the result is a complete confirmation of Mr. Graham's statements in every particular. *Not* to Mr. Whishaw, to whom, nevertheless, great credit is due, but to Mr. Graham really belongs the title of "Regenerator of the Society of Arts." Mr. Walker, the President of the Institution of Civil Engineers will understand what we mean by the phrase of "Regenerator," &c., and will refrain in future, we hope, from toasting his worthy ex-pupil by any such unmerited designation.—ED. M. M.]

CURIOUSLY FROSTED CAUSEWAY.

Sir,—I was very much attracted by the beautiful appearance, on Thursday morning, the 8th inst., produced by the frost on the large grey Rock-hill stone flagging in the Kennington-road, by which a continuous path, for a considerable length, was naturally and beautifully decorated. It appeared as if the flags were sufficiently dished to hold the principal moisture of the previous day about their centres. This had a brown tinge from the mud trampled over them by the numerous passengers; but the moisture being retained by the frost, a rich glossy effect was produced, and this being on the pale grey ground of the dry looking flags, gave rise to the appearance on each flag, throughout the entire footwalk, which I have here, though feebly, attempted to delineate.

The frost had in no part produced straight lines; the whole was a series of the most delicate curves, closely set together, forming a feather-like scroll pattern.

The extent, regularity, and beauty of this frosting, confined within the limits of each of the large flags on which it was displayed, would, it might be supposed, have excited the gaze and stayed the progress of the passengers. The passing crowd, however, scarcely deigned to notice the singular effect of Nature's handiwork in these configurations, which in a very few hours would be wholly obliterated. In the course of the morning, I saw other flagged footwalks similarly marked by the frost, but nothing nearly so conspicuous and regular. If you consider this notice worthy of a place in your valuable miscellany, its insertion will oblige, Sir,

Your obedient servant,

H. D.

Surrey, Feb. 10, 1844.

HOYLE'S "NEPTUNE CHARIOT," OR MARINE LIFE-PRESERVER.

[Registered under the Act for the Protection of Articles of Utility.]

Fig. 1.

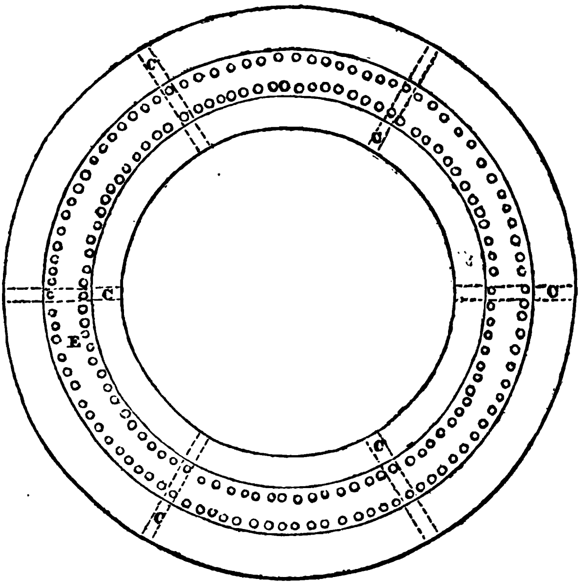


Fig. 2.

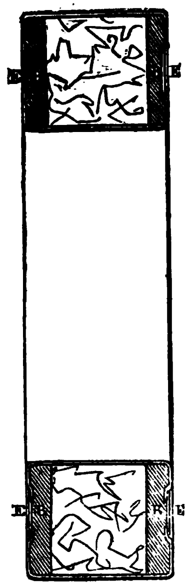


Fig. 1 is a top plan, and fig. 2 a sectional elevation, of this life-preserver.

The framework of it consists of two flat rings or hoops, A B, with broad raised edges or rims, placed about 5 inches apart, and connected together by x vertical stay pieces, C. The rings d stay pieces are each of wood, and out an inch thick.

The intervening spaces between the rtical stay pieces are filled with cork avings; and as each division is filled, o broad bands of waterproof leather brought over it (breadthwise), one m the outside, and the other from the side, and made fast, by means of some glue or cement, to the top and bottom of the top and bottom hoops, at the sunken parts between their raised rims. When the whole of the divisions have been thus filled up and covered in, the leather bands have a second covering of macintosh, or some other waterproof cloth, laid upon and cemented to them. Strips of thin plates of copper, E, are then nailed down upon the sunken parts between the rims of the two hoops, which serve still farther to keep the edges of the two coverings fast in their places. The apparatus is now complete; is impermeable to water; and possessed of extraordinary buoyancy.

The parts of this article of utility, which are not new or original, are, the whole of them, considered separately, each by itself; but the form and configuration, resulting from the combination and arrangement of them in the manner before described, is registered as new and original.

THE INVENTION OF ELECTROGRAPHY—MR. SPENCER IN REPLY TO MR. DIRCKS.

Sir,—My attention was drawn to an article in your Magazine by the following paragraph, which appeared in the *Liverpool Albion* of Monday last:—

"*Origin of Electrotype: Mr. Spencer not the Discoverer.*

"An elaborate paper, being a 'Contribution towards the History of Electro Metallurgy,' is just published in the *Mechanics' Magazine* of the present week: it is by Mr. Henry Dircks, of London, formerly of this town. Mr. Robertson, the respected and talented editor of that magazine, was, until the present time, a warm advocate of Mr. Spencer's claims; but, so convinced is that gentleman by Mr. Dircks' statements and arguments, that he falls in entirely with his views. Mr. Dircks gives, in succession, the names of Mr. H. Bessemer, Mr. C. Jordan, Mr. John Dancer, and only in the fourth place does he find a niche for Mr. Spencer. We imagine this paper will make some stir among scientific circles, there never having appeared, hitherto, much certainty as to whether or not Mr. Spencer was the original inventor, or a mere copyist. We really think Mr. Dircks' paper must be taken as confirmatory of the latter opinion."

I at once guessed Mr. Dircks was its author, having already had ample opportunities afforded me of this gentleman's peculiar talent, in thus drawing attention to his own productions; although I confess, in this instance he speaks in less flattering terms of himself than usual. On personal enquiry at the office of the *Albion*, I found my surmise still further confirmed.

I quote this paragraph, although not strictly relevant to my present purpose, that your readers may know something of the character of the man who has endeavoured, through the medium of your pages, to heap charges on me, little, if anything, short of dishonesty of purpose. No one acts up in argument to the trite saying "that two blacks do not make one white," more than I do; I shall therefore say the less of Mr. Dircks. Still I cannot help expressing regret that I have not a better opponent in this matter, or at least one of whose upright intentions in the cause of truth I was better assured.

I regret that you should have formed so hasty an opinion with respect to my claims as you seem to have done, in your remarks appended to Mr. Dircks' article. Had I not had the power of reply, nor a friend to make it, still there was enough in the article itself, not to go farther, to have, if not suspended, at least modified it.

Do not for a moment mistake me; I speak not in the spirit of recrimination, and shall ever feel grateful for the warm manner in which you advocated what you considered were my just claims, and can easily conceive how the same warmth of feeling should have led you into an opposite direction, when you considered that, to a certain extent, you had been deceived; but what I contend is, that had Mr. Dircks' statements been fully borne out, they did not quite warrant the conclusion you arrived at.

The main object of my present communication is to say, that my hands are at present full, and shall be so for the next three or four weeks; I shall then have time to string together some documents from well-known persons, which were collected in 1841, and which, I trust, will prove beyond all doubt, not only that I have never laid claim to more than I was entitled to, nor even as much, but that with respect to the discovery of electrotype, I was first in the field, and first in all subsequent improvements connected with it. This may be deemed egotism; but, Sir, there are times when a man must speak out, and the present I judge to be one of them. The documents I speak of as being collected in 1841, were for the purpose of insertion in the *Philosophical Magazine*, Mr. Richard Taylor being written to for permission, which he very kindly gave; but business interfered, and I thought as all seemed to acknowledge my claims, that it would perhaps be considered impertinent on my part, to thrust testimonials before the public in corroboration of that which they did not deny—so it fell through.

Still I have longed for a fair opportunity of publishing them, which I think is

now afforded me. One of these letters is from Mr. Dancer himself, in which the following sentence occurs, "I never did, to my knowledge, state that I had given you the first hint of your experiments." I cannot help thinking, that as respects myself, I was justified in deeming this an "*amende honorable.*"

I now request permission to insert the whole of the documents in question in your Magazine, along with such reply and explanations as may occur to me. They are far from being voluminous, and I shall make what I may think it necessary to add, as short as possible.

Mr. Dircks would have it inferred, that because I have not got rich with the electrotype, *ergo*, I am not the inventor. This gentleman is a very Nadgett* at worming into other people's circumstances with respect to pecuniary matters—it is one of his besetting sins. I thought, however, that the rule was, that an inventor did not get rich with his own invention, and I had comfortably set myself down as not being destined to form any exception.

Again, Mr. Dircks would argue, that because I have not followed the invention up, and have allowed others to take precedence of me with respect to it, that that affords another probability against me. But while I deny the legitimacy of both conclusions, in the latter instance I utterly deny the fact; on the contrary, I know of no signal improvement connected with the discovery which I have not promulgated; and, as something like evidence of this, I send you but a very brief, I may say imperfect, abstract of a paper read by me on the 10th of last October, at the Liverpool Polytechnic Society. This abstract, as you will perceive, was printed in the *Liverpool Standard* of the 17th of the same month. The paper itself was a voluminous one, and the numerous experiments connected with it required both time and strict attention. You will perceive it involves the practical application of a new principle, as connected with electrotype, and I know of nothing in the whole range of electrical science that presents us with such a beautiful variety of experiments, both philosophically and practically. The paper itself was destined for the *Philosophical Magazine*, and permission had been obtained for its insertion; but my rough notes require polishing, and this is far more labour to me than a whole range of experiment; and it required illustration with wood-cuts, of which I must have furnished the drawings. While slowly engaged with this, the sudden death of a parent occurred; it was then laid aside: however, I hope shortly to publish it, as at first intended. As delays are dangerous, (I speak, as you may admit, from experience,) I should be glad if you will insert this abstract in your columns. Nor is this the only labour of mine that has not found its way out of the columns of our Liverpool papers, which, were it not for the reporters connected with them, would not even have appeared there.

I am, dear sir,
Yours respectfully,
THOMAS SPENCER.

Liverpool, February 9, 1844.

[We are much obliged to Mr. Spencer for the abstract of the paper referred to at the conclusion of his letter, but it would be contrary to editorial etiquette, and even common literary justice, to anticipate, in the way he proposes, an article which he had previously promised in full to another journal. With respect to the further, and more satisfactory reply to Mr. Dircks, which he requests permission to insert in our pages at some future day, he is entitled to the permission, and we readily grant it. To every thing by which he can make good his title to the invention of electrography, once so earnestly and conscientiously advocated by us, our pages shall always be freely open. For the present we can but regret that Mr. Spencer should have thought it right to have forborne, from any cause whatever, even for a single day, that complete vindication which the statements of Mr. Dircks seemed to call for at his hands.—ED. M. M.]

* See Boz.

NEW GOVERNMENT CONTRACT FOR STEAMERS.

The Lords of the Admiralty have invited by a circular letter, the principal engineering firms to send in tenders before the 5th March, for the engine-fitting of four new steamers, two of the first class, and two of the second. The total weight of the machinery (with boilers filled) for the first class is not to exceed 350 tons; the second, 300. The engine rooms are to be of the following dimensions:—

	First class.		Second class.	
	ft.	in.	ft.	in.
Length in the clear....	54	0	50	0
Breadth	34	4	33	0
Depth..............	23	0	21	0

(The centre of shaft to be *above* the water line.)

The coal boxes (included within the space allowed for the engine rooms) are to be capable of containing not less than 400 tons of fuel for the first class, and 350 for the second, reckoning each ton as equal to 48 cubic feet.

The tenders are to state the highest power, which the engines proposed to be erected within the above spaces are capable of exerting, at 7 lbs. per square inch of effective pressure, and at the following rates of velocity of the piston :—

ft.	in.			
4	0	stroke	196	per minute.
4	6	,, ...	204	,,
5	0	,, ...	210	,,
5	6	,, ...	216	,,
6	0	,, ...	222	,,
6	6	,, ...	226	,,
7	0	,, ...	231	,,
7	6	,, ...	236	,,
8	0	,, ...	240	,,

"*If any other than* BEAM engines are proposed, they must be described very minutely, with proper drawings or models." The form of words which we have marked in italics would lead one to suppose that the Lords Commissioners entertain but an indifferent opinion of "any other than beam engines;" but the fact is so notoriously the reverse—the superiority of the direct-action engine is now so generally (we had almost said universally) admitted—that we can scarcely be wrong in regarding it as but a specimen—somewhat ludicrous—of the excess to which official caution is occasionally carried. The dimensions which their Lordships have assigned for the engine rooms are quite incompatible with the preference of beam engines which their *words* would seem to imply. To make it a question how much power can be included within a given space, is at once to exclude the beam engine from all chance of competition; and this is done by their Lordships, in terms express enough, by the following *nota bene*:—"Those tenders however, which place engines of sufficient power in a space less than 54 and 50 feet, and give the largest stowage of coals, will be preferred."

The boilers are to be of the tubular construction, and to be constructed in three, four, or more separate parts, capable of being used independently of the others. A space of 13 inches wide is to be left clear between the boilers and the coal boxes in every part.

The following are some subordinate particulars :—

"The holding down bolts are to be secured by nuts let into the lower sleepers, so as not to require the bolts to pass through the vessel's bottom, and the bolts are to have at the lower ends of their points wrought iron washers, about 8 in. square and 1 in. thick, placed between the nuts and the wood. Should this mode of security be inapplicable to the particular kind of engine proposed, the engineer is fully to describe any other secure mode which he may think the most advisable to adopt.

"The pistons are to be fitted with metallic packing. The blow-off pipes are to be $3\frac{1}{2}$ in. in diameter, and not less than $\frac{1}{4}$ in. in thickness.

"Discharge or escape valves are to be fitted at the top and bottom of each cylinder, for allowing the escape of water therefrom; the valves to have suitable metallic cases, to prevent danger of persons being scalded by escape of boiling water, reverse valves are to be fitted to the boilers, and stop valves at the ship's side to the waste water pipes.

"Each cylinder is likewise to be fitted with a separate movement and valve, for the purpose of using the steam expansively in various degrees, as may from time to time be found eligible. The air pumps are to be lined with gun metal of $\frac{1}{2}$ in. in thickness when finished. The air pump buckets are to be of gun metal, with packing rings. The air pump rods are to be of gun metal or Muntz metal, or of wrought iron cased with gun metal.

"The threads of all screwed bolts, nuts, and pins used in engines and boilers, and in every other part of the work furnished by the contractor, are to agree with the threads used in the steam department at Woolwich.

"A small engine is to be fitted capable of working one of the pumps for feeding the boilers, in every case when the boilers are tubular. Pipes to be fitted for supplying, in the event of a leak in the vessel, the requisite quantity of water from the bilge to the condensers.

"The hand pump to be made capable of being worked by the engine also, and to be arranged to pump into the boilers on deck or overboard, and to draw water from the boilers, from the bilge, or from the sea. The feed apparatus to be complete, independently of any feed from a cistern above the deck, should such be fitted.

"The steam pipes, and all other pipes, to be of copper, and their respective thicknesses and diameters to be specified in the tender. A separate damper to be fitted to every boiler. Brine pumps, or some other equally efficient apparatus, with refrigerator, to be fitted to the boilers, and blow-off pipes so arranged, that any boiler may be blown off separately.

"A small flat iron vessel to be fixed in one of the paddle-boxes, with two pipes, one communicating with the stoke-hole, and the other with the boiler, for obtaining a small supply of distilled water from the boiler.

"Air tubes to be fixed in the coal boxes, for ascertaining their temperature.

"The paddle-wheels are to be of the common construction, and to be fitted with suitable breaks.

"All the necessary ladders for the engine room, together with fenders, guard rails, and floor plates, are to be included in the tender, and likewise the expense of trying and fitting the spare gear.

"The expense of CLOTHING (in the following manner) the cylinders, steam pipes, and boilers, is also to be included in the tender.

"The cylinders are to be covered with hair felt to the thickness of two inches, the felt is to be covered with thoroughly dried wood, well fitted, and bound together by iron or brass hoops.

"The steam pipes are to be clothed with felt, which is to be moulded with spunyarn, and then to be covered with canvass, the whole to be of such thickness as to be even with the flanches.

"After it has been ascertained by trial that every part of the boilers is perfectly tight, two good coats of red lead paint are to be put on them, and felt applied to the tops, sides, and ends, to the thickness of two inches, while the paint is moist.

"For the more convenient application of the felt, it is to be previously stitched to canvass for the purpose of holding it together. The canvass is then to be well painted, and carefully covered with thoroughly dried one inch deal boards, having rabetted or grooved and tongued joints, and bound up to the boilers with suitable iron stays.

"The coating of felt and boards on the top of the boilers or steam chest is to be kept at least 18 in. from the funnel, and the circular space between the coating and the funnel is to be covered with a 3 in. course of bricks set in cement, and surrounded and held together by an iron hoop.

"The boards and bricks on the upper parts of the boilers are to be covered with sheet lead, 4 lb. to the square foot, so as to prevent any leaks from the deck reaching the felt.

"It is to be understood that the practice of fixing new engines on board Her Majesty's vessels at Woolwich Dockyard is to be entirely discontinued. The ports to which their Lordships will, for the convenience of manufacturers, allow vessels to be taken, are those of London, Liverpool, Greenock, Glasgow, and Dundee, provided the places at which the vessels are to be in those ports shall be named in the tender, and approved of by their Lordships.

"In the case of vessels receiving their engines on board in the port of London, they will in the first instance be brought to Woolwich; and no subsequent charge will be allowed for transporting the vessel to the place where they are to be fixed on board; for coals in trying the engines until they are complete; for boats, anchors, men, lighters, pilotage, canal or dock dues, shipwright's work, or for any other expense whatever occasioned by the engines not being fixed on board at Woolwich. The 'watching' of vessels is to be performed in future by officers and men in Her Majesty's service; but no shipwrights will be provided by Government.

"In all cases of vessels receiving their engines on board at any other port than that of London, a deduction of 2 per cent. will be made from the price of the engines named in the tender, as a compensation for the expense, wear and tear, and risk thereby incurred."

THE DOUBLE-STORIED BOILERS.

Sir,—A subscriber to your Magazine has directed my attention to two communications in it, with the signatures M. J. F. and R. W. respectively. (See No. 1067 for 20th January, and 1068 for 27th January.) I am astonished at these belligerents contending for the honour, and bestowing the merit of the tubular boilers referred to, upon their respective parties, the one on Mr. Joseph Maudslay, and the other on Mr. John Seaward. I am astonished at this, the more so when it is *notorious* that neither Mr. Joseph Maudslay nor Mr. J. Seaward has the smallest claim or merit in the matter. Why, Sir, it was *patented* and particularly specified by James and William Napier, of Glasgow, in 1830, and in that same year applied by them to steam vessels. It was not only so in a single case, but they have manufactured and fitted up vessels with these boilers which have been trading to all the principal ports in Great Britain, and they have been doing that for a dozen

of years back. Vessels of 200 and 300 horses' power are well-known to have been sailing regularly every week to and from the port of London since the commencement of 1833, and during the whole of that period these vessels have had only James and William Napier's *patent* boilers on board. Now, Sir, with these known public facts, it is too bad to find that the plans are pirated, and the merit of the invention attempted to be given to Mr. Joseph Maudslay by one, and to Mr. J. Seaward by another, and thus robbing the real originators of their just rights; for be it remembered (and it is not so well known) that the introduction of these boilers has been attended with no small difficulty to James and William Napier. They have had to contend with fixed, ignorant, and interested prejudices, and have had to give guarantees of security, and submit to penalties and responsibilities in their contracts for these boilers, which no engineer in the regular course of his business would ever submit to. It may also be stated that James and William Napier have manufactured these boilers with tubes of one, two, and three stories, varying from $1\frac{1}{2}$ inch to $10\frac{1}{2}$ inches in diameter, and from five to sixteen feet long. The specification of their patent, however, comprehends all lengths, and all forms, and all numbers. The writer of this, being one of the patentees, thinks it right also to state that these boilers were proposed and recommended in 1832, to Sir James Graham, then first Lord of the Admiralty, and also to Sir Thomas Hardy, then one of the Junior Lords.

I am, Sir,
Yours respectively,
JAMES NAPIER.

Washington-street, Glasgow, February 8, 1844.

IMPROVEMENTS IN THE APPLICATION OF HORSE-POWER TO PURPOSES OF DRAUGHT.

Sir,—I think your correspondent in No. 1069 of your Magazine, on Mr. Moat's invention, will find that the idea of applying an approved method to animal or horse locomotion is not new. I do not know the date of Mr. Moat's patent;* and being away from home, have no convenient reference to ascertain; but some years ago he will find in your Magazine the description and drawing of a method of applying horse-power on the same principle, by Mr. Curtis, a civil engineer. Mr. Curtis had also, I believe, been anticipated by a Mr. Peppercorn, whose invention I have seen described in Newton's Journal. There is also an invention of a Mr. Parkin, described in your Magazine, the purpose of which is absurd enough, but involving the same principle.

The object of obtaining a better means of applying horse-power than by ordinary draught, is well worthy of attention, as it is admitted to be by far the most economical sort of power. Indeed it is doubtful, now that the principal lines of greatest traffic have been monopolized, whether the costly steam locomotive can possibly be maintained on secondary or feeding lines of railway; and if so, the extension of the railway system in England must be soon brought to an end. I think that, leaving out of view the construction of Mr. Moat's machine, which sets all the rules of carriage construction at defiance, there is a fallacy in applying wheels of the size indicated by Mr. Moat, and also that it is a fallacy to suppose that the whole weight of the horse may not be brought to bear in locomotion. In fact it is *because* a very small part only of the horse's power is involved in ordinary draught (estimated by some at no more than $\frac{1}{7}$th of the whole), that an improved method is desirable. If it be a fact also that the surface friction of common roads to that of railways be as 10 : : 150, or thereabouts, the advantage of horse locomotion, according to the method described, ought not to be confined to ordinary roads. A constant average speed of 12 or 15 miles an hour on railroads, by horse locomotion, would at its low cost afford an important competition with the steam locomotives, or perhaps a very important adjunct, by working on subsidiary lines which would not otherwise pay.

I am, Sir,
Your obedient servant,
G. R.

January 9, 1844.

* The date is Feb. 5, 1840.—ED. M. M.

MR. HAM'S IMPROVED BAROMETER—A FARTHER IMPROVEMENT SUGGESTED.

Sir,—It is certainly not impossible for several persons independently to originate similar ideas; but it is rather remarkable that you should have had three communications of the same principle at pp. 32, 34, and 37 of your current volume, though in one instance differently applied from the other two. My object is not to interfere with the claims to priority, but to suggest an improvement in the graduation of the scale as applied by Mr. Ham.

I would have one tube marked at the centre as a zero point for distilled water, and the other tube marked with a scale of real spec. grav., at 60° or 55° (the temperature to which it is stated to be adjusted). It would

then show æther at the point marked 75°, high up the tube, and sulphuric acid at 184·5, low in the tube, while mercury would be 1350, very near the point *a*, and distilled water at 100, on a level with zero on the other tube. I think the principle a good one, and wonder that it has not been thus applied before. In trying æther, a 2 oz. wide-mouth bottle might be used with a perforated cork, thus preventing evaporation, leaving a small aperture in the cork, to allow the free pressure of the atmosphere. A couple of 2 oz. measures, or wine glasses, would be sufficient in ordinary cases.

I am, Sir, yours, &c.,

H. O.

February 2, 1844.

AN IMPROVEMENT IN ARROWS.

Sir,—Having often experienced the inconvenience of an arrow splitting in the neck at the instant of discharging it from the bow, and having tried many ways to remedy this defect, I have thought of applying the electrotype process to attach a copper sheathing to the neck of the arrow, in place of the inserted horn; and this contrivance, after successful trials, I venture to recommend to all lovers of the healthful and social exercise of archery.

SAGITTARIUS.

MUNTZ'S COPPER SHEATHING PATENT.

Court of Common Pleas, Feb. 8—12.

(*Before Lord Chief Justice Tindal and a Special Jury.*)

Muntz, M. P. v. *Foster and others.*

The Attorney-General, the Solicitor-General, Sir T. Wilde, Mr. Serjeant Bompas, Mr. M. D. Hill, and Mr. Cowling, were counsel for the plaintiff; and Mr. Kelly, Mr. Jervis, Mr. Serjeant Channell, and Mr. Webster appeared for the defendants.

The action was brought for an alleged infringement of a patent granted on the 22nd of October, 1832, to Mr. G. F. Muntz, of Birmingham, for "an improved manufacture of metal plates for sheathing the bottoms of ships and other such vessels." About 50 or 60 years ago the practice of sheathing the bottoms of vessels with copper was introduced. But the use of copper was found to be attended with two great objections—first, it corroded rapidly under the action of sea-water; and secondly, being fastened to the bottom of the ship with iron nails, the iron soon rusted, the fastenings ceased to hold the metal, and the copper came off. Sir Humphrey Davy turned his attention to the subject, and endeavoured to devise some method for counteracting these evils. It struck Sir H. Davy that if a portion of zink were applied to the copper, it would counteract the process of oxidation; and a vessel sheathed with copper and zink plates, in accordance with his theory, was sent a voyage to a distant part of the world, from which it returned perfectly uninjured, so far as the bottom was concerned, by the salt water, but, at the same time, as foul, from the adherence of barnacles and seaweed, as if there had been no metal at all upon the bottom. The problem, therefore, still remained to be solved, whether any metallic composition could be found for the sheathing of ships by the use of which the bottom could be kept clean, and at the same time too great a degree of oxidation might be prevented. To the solution of this problem Mr. Muntz directed his mind, and commenced a series of practical experiments, for the results of which he took out a patent in 1832. The invention slowly but steadily attracted the notice of the shipping interest of the country. It appeared that in 1834, in the port of London, 20 ships were sheathed with metal under Muntz's patent, and that the number gradually increased, till, in 1843, there were in the same port 257 vessels sheathed with the new composition, of which 17,947 cwt. were sold in the last-mentioned year. The composition was a mixture of copper and zink, which was cheaper than copper, was more easily worked, and lasted longer, being also sufficiently hard to allow of its being fastened to the sides of the ship with nails of the same composition. The specification of the plaintiff's patent thus described the nature of his invention:—"I take that quality of copper known to the trade by the appellation of 'best selected copper,' and that quality of zink known in England as 'foreign zink,' and melt them together in the usual manner, in any proportions between 50 per cent. of copper to 50 per cent. of zink, and 63 per cent. of copper to 37 per cent. of zink, both of which extremes, and all intermediate proportions will roll at a red heat; but, as too large a proportion of copper increases the difficulty of working the metal, and too large a proportion of zink renders the metal too hard when cold, and not sufficiently liable to oxidation, I prefer the alloy to consist of about 60 per cent. of copper to 40 per cent. of zink." It was proved by the testimony of several witnesses who were examined on the part of the plaintiff, and who were not contradicted, that any person acquainted with the trade of a metal-roller could manufacture this composition from the description of the invention contained in the specification; and it appeared that between February and April, 1843, the de-

fendants had made a quantity of sheathing, amounting in value to about 700*l.* or 800*l.*, some of which was sold by them in Liverpool, and which was declared, upon subjecting it to a minute analysis, to be as nearly as possible composed of the same proportions of copper and zink as those pointed out in the plaintiff's specification as the best alloy for the purpose, namely, 60 per cent. of copper, and 40 per cent. of zink.

The defence to the action was, that there had been no infringement of the patent; that the invention was not new, and that Mr. Muntz was not the first and true inventor, and also, that the specification was bad for uncertainty, &c. Upon the first point, the infringement, the evidence seemed very clear; but the main ground of defence was, that in the year 1800 a Mr. Collins took out a patent for a composition for sheathing ships, which, it was argued, was substantially the same invention as that which the plaintiff claimed as his own. The specification of Collins's patent said, "The yellow sheathing (the sheathing in question) consists chiefly of zink and copper. The compound must be heated, and in that state rolled; 100 parts of copper and 80 of zink afford a good composition, but the proportions may be varied, or other metallic substances added, provided the property of bearing the mechanical process, when added, is not destroyed." Evidence was given on the part of the defendants to show that some of the metal sheathing made by them after April 1843, was made from the specification in Collins's patent alone, and several witnesses were also called to prove, on their behalf, that a composition of copper and zink, in the proportion of 60 per cent. of the former to 40 per cent. of the latter, had been made in the years 1828 and 1829, but it did not appear that any *plates* of this composition had ever been applied to the sheathing of ships.

The Lord Chief Justice left it to the jury to say, in the first place, whether there had been any infringement of the patent granted to the plaintiff, assuming the patent to be good; secondly, if so, whether the manufacture was a new invention, or whether it had been already made public by Collins's patent; and, thirdly, whether the specification of the plaintiff's patent was sufficiently plain and intelligible to enable other persons to make the composition for which the patent had been granted. His Lordship gave it as his own opinion, upon the matters of law arising in the case, that the nature of the plaintiff's invention was well described by the title of the patent—"An improved manufacture of metal plates for sheathing the bottoms of ships or other such vessels;" that neither "best selected copper" nor "foreign zink" formed essential parts of the invention, which consisted in the discovery of a composition for sheathing by which a proper degree of oxidation was obtained, and no more; that rolling the metal at a red-heat was not claimed as part of the invention; and that the invention did not particularize any proportions but those of 60 per cent. of copper, and 40 per cent. of zink, as applicable for the purpose of making his metallic sheathing, although he had designated other proportions between the extremes of which the metals would melt at a red-heat.

Mr. Kelly tendered a long bill of exceptions to this ruling.

The jury found for the plaintiff—Damages 40s.

NOTES AND NOTICES.

Lights for Lighthouses.—At the Academy of Sciences, Paris, on the 8th Jan., a paper, by M. Francois, was read, "On Lights for Lighthouses." That gentleman has succeeded in manufacturing lenses of much greater power than any before known; so powerful is their illuminating property, that from an experiment made at the observatory at Paris, it was proved that a revolving lamp of four wicks gave a light equal to 140 Carcel lamps, while the oil used was only 700 grammes (1½ lb.)—a single Carcel lamp consuming 42 grammes. M. Arago observed, in respect to this invention, that an order had been received for their application in England.

The Plough in the West Indies.—Lord Elgin, the present Governor of Jamaica, has given it as his opinion, "That by the substitution of the plough for the hoe, and the introduction of improved modes of cultivating the land, and manufacturing sugar, fifty per cent. more sugar may be raised than is raised at present."

The Solar Rays.—A communication from M. Melloni was lately read at the Academy of Naples. Newton, from his experiments, inferred that all the refrangible rays of white light possessed proportionate degrees of heat to their colouring intensity; this opinion has been modified by Herschell and other modern philosophers, who have fixed the red band as the boundary occupied by the maximum heat, but they are not agreed as to the position of this point. Seebeck showed that the discordance arose from the action of the diaphonous substances, with which the light was decomposed, but to explain how colourless substances, producing no variation in the relative intensities of luminous elements could exercise various actions on the calorific flux, was left to M. Melloni, who has demonstrated that substances which leave a free passage to the light, intercept certain calorific rays, and exercise a varied, but specific action, as coloured glasses do upon the white light. It only remained to discover a substance which would allow a free passage to all the rays of heat, and he has successfully done this by using rock salt; by this he has been able to determine the maximum of heat beyond the red band, equally distant from that which separates the extremity of the luminous spectrum from the yellow.

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MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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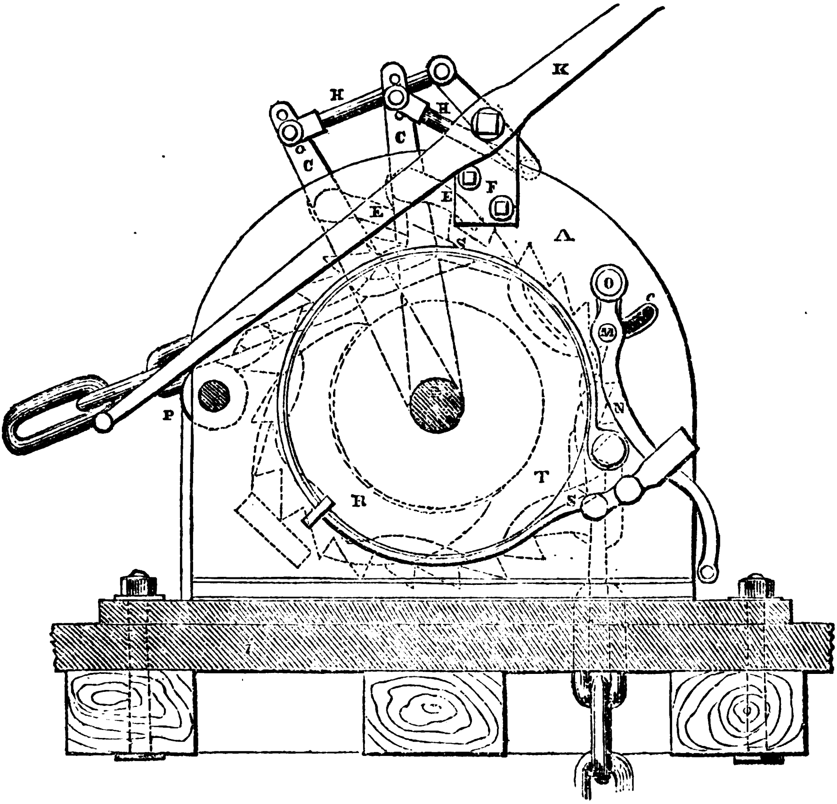
Edited by J. C. Robertson, No. 166, Fleet-street.

BROWN'S PATENT DOUBLE RATCHET CABLE STOPPER.

Fig. 1.



BROWN'S PATENT DOUBLE RATCHET CABLE STOPPER.

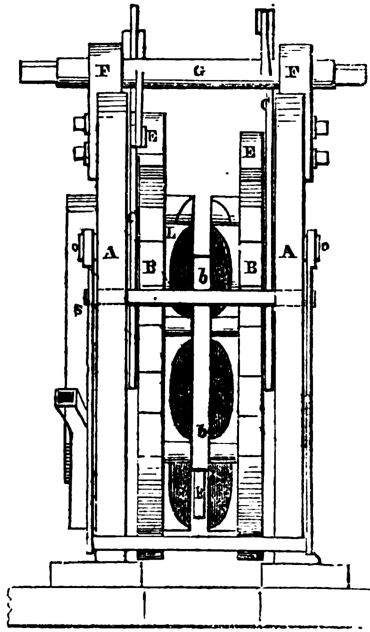
[Patent dated, August 16, 1843; Specification enrolled, Jan. 16, 1844.]

The double-ratchet cable stopper represented in the prefixed engravings is one of fifteen different contrivances connected with the machinery in ordinary use for the working of chain cables and tillers, which Mr. Brown (of Stepney) has protected by patent. The *first* is a cable controller, the novelty of which consists chiefly in its being fixed more securely in its seat than those in ordinary use. The *second* is a controller which is brought into its holding and liberating positions by means of an eccentric. The *third* is a controller distinguished from the others by its having a framework made of wrought iron bars, in lengths adapted to the build of the vessel to which the apparatus is to be applied. The *fourth* and *fifth* are two new sorts of box stoppers. The *sixth* consists in a combination of a box stopper with what the patentee calls a "cable drag or stop compressor." The *seventh* is an underdeck compressor. The *eighth* is a new weather-bit, which is characteristically designated as the "always-ready weather-bit." The *ninth* is the double-ratchet stopper which forms the special subject of this notice. The *tenth* is a modification of the ninth. The eleventh is a new form of pulley. The *twelfth, thirteenth,* and *fourteenth* are new forms of links intended to supersede the common shackle or swivel. And the *fifteenth* is a new steering apparatus.

There is a great deal of most praiseworthy ingenuity and practical cleverness shown in the whole of these inventions. We cannot at present afford room for more than the specimen we have selected; but as opportunity offers, we shall give hereafter descriptions of some of the most striking of the remainder of the collection. The double-ratchet stopper, of which we proceed to lay the inventor's description before our readers, is the most powerful and efficient instrument of the sort we ever remember to have seen:—

"Figure 1 is a side, and figure 2 an end elevation of a double ratchet revolving machine applicable to the heaving cables and 'getting,' as it is termed, the anchor. A A are the two side plates, which may be either of iron or wood, to which the other parts are connected; B B are two ratchet wheels; C C are two levers, the lower ends of which are centred upon the axle D (or on any other convenient bearing); E E are two palls attached to those levers and working into the teeth of the ratchet wheels (the number of palls may be either one or two, or more as may be required); F F are two brackets, bolted to the side plates, and forming the bearings for the journals of a rocking shaft G; H H are two rods, which connect the arms I I on the rocking shaft with the upper ends of the levers C C; K K are two

Fig. 2.



double-armed handles, which are placed one on each end of the rocking shaft, to which the power is applied; on these being raised and depressed in manner like to the working of a pump, a rotary motion is communicated to the ratchet wheels, and the intervening toothed pulley L (by the palls E E) in the direction from left to right. The pulley L is toothed in such a manner, that it shall answer the pitch of the chain, or cable, so that while every other link falls into and occupies the spaces *a a a* (fig. 2), the intervening links occupy those in the groove *b*, being carried all round the pulley, so that the under edges of the links may fall therein.

Every other link of the chain is thus embraced by a tooth, and partakes of the onward motion communicated to the ratchet wheels. M is a roller, which passes across the machine, and through elongated holes *c*, in the two side plates. N N are bent levers which revolve upon their centres O O, and are connected to the ends of the roller M. The combination of the roller M, and levers N N, has the effect of a pall in preventing the return of the ratchets and pulley. The cable is allowed to pass off at the back of the machine down through the chain funnel, in the manner shown in figure 1; it is received at the front part on the roller P. The piece of metal R, which is indicated by dotted lines in figure 1, and the edge of which is seen in figure 2, is intended to prevent the chain being carried round by any of the links becoming partially fixed. S is a friction strap, which embraces a pulley T on the outside of the side-plate A, and by which the cable can be let off at pleasure. When the cable is let out, the palls E E, are first lifted up and held out of their place; then, the roller pall M, being raised off from the teeth of the ratchet wheels, the pulley L is at perfect liberty to turn in any direction."

The patentee observes that the double-action principle of the apparatus above described, "may be adapted to the common windlass by attaching two ratchet wheels, one to each end of the body of the windlass, and having a rocking shaft going from bit to bit, to which cranks, with falls, are affixed. When an up and down motion is given to the rocking shaft, the chain, or rope will be hove in. Or instead of having ratchet wheels, as above described, the palls from the working shaft, may work into, and upon the common pall plate of the windlass."

CONTRIBUTION TOWARDS A HISTORY OF ELECTRO-METALLURGY. SECOND PART. BY HENRY DIRCKS, ESQ.

(Continued from page 78.)

In the former part of this paper I in-t-luced to notice Mr. H. Bessemer, of v-om I have but a very slight personal k-wledge; also Mr. C. J. Jordan, *the* d-*coverer of Electrography*, who is t-lly unknown to me; thirdly, Mr. J. B. Dancer, an ingenious electrician, with w-om I have been long on terms of in-t-cy; and finally, Mr. Thomas Spencer, o-hom I know very little beyond having o-sionally met him in public. The ten-o-r of my remarks is obviously such as to persuade every impartial reader, on the evidence adduced, that Mr. Spencer has hitherto maintained a very false position, merely owing to the singular circumstance of his unjustifiable claims never having before been contested. The consequence has been not only the leading of our own scientific writers into error, but likewise those on the Continent, thus the Royal Academy of Paris affords, in an elaborate memoir on the subject, read last year, an eminent example of the consequence of neglecting the earlier adjustment of this claim to discovery. Since the publication of the first part of my historical sketch of the metallurgic art, Mr. Spencer has thought proper to publish letters in the *Mechanics' Magazine* and *Liverpool Albion*, quite in the style of one who is *Gratis anhelans, multa agendo nihil agens.* It is impossible I should here avail myself of those letters, as they contain nothing but abuse and misrepresentations,* and the very strange subterfuge, that his "hands are at present full, and *shall* be so for the next three or four weeks." Half the time and space occupied in writing a letter containing matter to the purpose would have produced a letter which would have been willingly inserted by all the leading journals throughout the kingdom. But Mr. Spencer being immersed in mesmeric experiments on a Mrs. Tod, a Scotchwoman, and which has led to his reading a paper before the Liverpool Literary and Philosophical Society on certain phenomena of *clairvoyance*, most injudiciously allows such pursuits to take precedence of what is at present a far more urgent and important engagement, his offering immediately those proofs of his rightful claims to a disputed discovery, which he would have us believe he possesses, and has had prepared since 1841.

I had originally intended to have con-

* As examples;—I am charged by him in the *Liverpool Albion*, with "dishonesty of purpose;" but what he may mean by this I know not. In the *Mech. Mag.* Feb. 17., p. 107, he upbraids me with inferring, that because he has "not got rich with the electrotype," and again, because he has "allowed others to take precedence of him," in carrying it out, *ergo*, that he is "not the inventor." I warn Mr. Spencer to keep to facts. I defy him to find any such inference, as he here states, in my paper of Feb. 3. It is a poor cause that requires any resource short of a strict adherence to truth; and surely Mr. Spencer must have known these were direct falsifications when he penned them, else he is an unpardonably hasty and inconsiderate writer.

fined my remarks to my first paper, but this extension of the subject, relating to Mr. Spencer, is called for and invited by his recent assertions. To set myself right with the public, and prove the absence of any under current of private motives, I desire to observe at the outset, that I am not aware of having seen Mr. Spencer for the last three years (certainly not above once); I have never been in any way indebted to him, or he to me, and have no unfriendly feeling towards him personally. I have taken up this matter solely from its having been so long unnoticed by others. The only personal affront Mr. Spencer can be said to have offered me must date from his letters within the last fortnight, but which I willingly excuse.

I shall now, without waiting for the advantage of any thing Mr. Spencer may be reckless enough to bring forward to support his assumed rights, proceed at once to lay bare such an example of plagiarisms as is perhaps without a parallel in the whole history of science, when honour, more than emolument, has been the object of contest. It is requisite, however, that I should early fortify my position, by unravelling a little the mystery under which Mr. Spencer has somewhat ingeniously, and with success so far, enveloped all that appertains to his proceedings. It will be recollected that he announced to the Liverpool Polytechnic Society, May 8, 1839, that he had a process of applying galvanic agency for effecting the deposition of metals, which announcement he made fearing he should be anticipated, rumours being afloat respecting Professor Jacobi's galvanic engraving. It might have been supposed, that from Sept. 1837, when he claims to have first commenced experiments in electro-chemistry, to, say June 1839, would have afforded him time sufficient to lay before the Society a very fair outline of his announced discoveries, *if any were really made*. But no—neither then, nor in June, was the Society favoured with his communication—a Society of which he was a member, and to which, in case of claims to priority, he meant to fly for proof of his announcement. The "common carver and gilder (for Mr. Spencer claims to be nothing more)"* could rest satisfied with no channel of communication short of the British Association, to meet in Birmingham the August following. It was thus he made a convenience of the Polytechnic Society to secure his supposed rights, and sacrificed to his ambition his own interests—(supposing him to have had some real and honest interests to protect)—to appear before the assembled philosophers of Europe! How he missed attaining the summit of his wishes—how his proffered revelation was most uncivilly declined—he has himself related—and those who are curious to know all the particulars may refer to his own narrative. On the 12th September, 1839, the revelation of Mr. Spencer's much vaunted discoveries, declined by the British Association, was permitted to be made to the Liverpool Polytechnic Society; which at a public meeting on the 13th January, 1841, handsomely awarded him a prize of ten pounds for the subject of his communication.

The *Mechanics' Magazine* was foremost to take up Mr. Spencer's cause; no eulogy that could reasonably be bestowed on him was spared; quotations illustrating the warm advocacy of that long established and widely-circulated journal in his favour occur in the first part of this paper. In vol. xxxiii. for 1840, we find him, at page 208, associated with Professor Jacobi, in an abstract from a Munich paper; at page 324, Mr. W. A. Kentish pays him a similar compliment; at page 373, Mr. Spencer's pretensions afford the principal portion of extracted matter in a review of Mr. W. Savage's Dictionary of the Art of Printing; while at page 491, the editor's honest warmth of feeling for depressed and unappreciated genius (as he then supposed) knows no bounds short of proposing that "A grant of a few thousands to so successful a contributor to the arts of peace as Mr. Spencer would garland the way, by which the losses of many wars might be repaired!"

Turn we now, after a lapse of little more than three years, to his letter in the *Liverpool Albion* of February 12, in which he very coolly and deliberately delivers himself after this manner—"I have just read the article in the *Mechanics' Magazine*, (Feb. 3.) and I shall find but little difficulty in making a satisfactory, and, I trust, final reply to it. In all probability I shall do this in the pages of the Magazine in question; or, possibly in one of a higher character (!), in order

* *Mechanics' Magazine*, vol. xxxiii. 1840, p. 492.

that this part of the question may be set at rest. I only wish, however, I had a better man to refute than Mr. Dircks." (!) It must have been in much the same spirit that he at first estimated the British Association as an institution *better* calculated to establish his fame than, (as he would consider), a merely provincial Polytechnic Society; in a like strain too he here distinguishes our scientific journals, and can actually speak of a *better* one than the *Mechanics' Magazine*, under the offensive insinuation of his possibly patronizing, "one of a higher character." Supremely quixotical, indeed, is his questioning of the writer's character; but the same sentence offers a grave charge against him of deep ingratitude for speaking slightingly of a journal which, more than any other, has contributed to direct public attention to his labours; to maintain his supposed rights; to publish his productions; warmly to second the claims urged by himself; always his apologist and friend; and which has to the uttermost endeavoured to promote his welfare, with all that benign and enthusiastic spirit which is ever ready to extol and foster genius—particularly if supposed to be labouring under difficulties.

As far as regards the mystery of Mr. Spencer's successful usurpation of Mr. Jordan's place, that has perhaps been sufficiently accounted for. Another mystery remains to be noticed; it is that of the wonderful accumulation of coincidences of which Mr. Spencer has been the ill-fated victim! To do more than enumerate them here would be almost an act of supererogation; those chiefly alluded to are:—

1st. That of carrying out usefully voltaic action to working in metals, *just after* the publication of Mr. Jordan's process.

2nd. That of obtaining compact copper instead of the usual friable and brittle quality, *just after* Mr. Dancer had shown him the first specimen obtained by his new plan of porous earthenware jars.

3rd. That of his theory and practice of soldering metals, some time *after* the French patent of M. de Richemont's autogenous soldering, using jets of flame produced by air and hydrogen. (See both in the *Mech. Mag.*,* vol. xxxii., 1840, p. 546, and p. 729; and vol. xxxiii., pp. 44, 126, 262.)

4th. The circumstance of his inventing corrugated copper plates for the jar batteries, *just after* Mr. Dancer had contrived and made several on the same principle.

5th. His suggesting a new view of heat in a paper on the subject of atmospheric electricity, read before the Liverpool Literary and Philosophical Society, long *after* it had been published, and the doctrine he claimed as original and his own had been discarded.

No one acquainted with the particulars brought to light so far in my present and former communications, can peruse attentively Mr. Spencer's paper on the electrographic process, read before the Liverpool Polytechnic Society, and which next comes under consideration, without detecting the spirit of detraction and determinate appropriation that incessantly obtrudes itself. He has studiously endeavoured to appear as standing alone, originating all the experiments he has adduced, prompted only by the suggestions peculiar to a philosophically inclined genius. Finding, however, that he must work with some apparatus, not of his own invention—make applications, in which he was tremblingly conscious he had been anticipated by Mr. Jordan, and attempt to vary applications which he had barely more than the talent to multiply, his course was considerably circumscribed; wherefore, he has proceeded as if he had hoped that past experiments, and the results obtained by others, would be lost by blazoning forth his repetitions of those ex-

* In an editorial note it is observed—"Mr. Spencer, however, while thus asserting his own claims to originality, very frankly and honourably adds, that he has no doubt whatever (!) M. Richemont made the discovery first, and that he has no wish or intention to interfere with the rights of the English Patentee." Mr. Spencer had on the 14th May, 1840, read a paper on the subject to the Liverpool Polytechnic Society; and very complacently boasts of his having announced it to the Society "as far back as the 18th February," 1840, all which, till we know the facts, must be considered very fair and straightforward. And so it has been considered, with no small share of praise to Mr. Spencer for his apparently urbane conduct! But what shall we say of Mr. Spencer, at the very time a subscriber to, and reader of the *Mechanics' Magazine*, when it is known in connexion with the foregoing, that in vol. xxx., of the Magazine, on 30th March, 1839, page 480, is given (nearly twelve months before his announcement) a notice of M. D. de Richemont's having invented his apparatus for soldering lead, called "aerhydric pipes," with the nature of his process? The English patent for the same was sealed July 1838.

periments as his own discoveries, which, at the worst, he could but yield up when claimed. Yet, as if to let no chance escape of establishing his title to the highest claims of being a discoverer, he seems to have thought it requisite to reduce, as much as lay in his power, the importance of published opinions by suitable inuendoes; and, above all, to avoid stating any point capable of being construed into a favourable opinion of the labours of others, or as distinguishing his own knowledge of their labours in the same field.

Now for the proofs that these are more than merely vague charges. I shall show the plagiarisms of his first published paper.* There is no doubt Mr. Spencer claims originality, otherwise he would not give his experiments, as he declares, for "illustrating the progress of discovery," p. 9; or speak of "the present simple discovery," p. 10; or of not having produced "a perfect invention," or of imagining he has "discovered a useful application of an important principle," p. 11; or commend the subject of his paper as "the present simple discovery," p. 10.

It was in the *Athenæum* for May, 1839, that he first saw a notice of Professor Jacobi having discovered, in the words of the paragraph, "a method of converting any line, however fine, engraved on copper, into relief by a galvanic process."† In consequence, on the 8th May, 1839, as was before stated, he announced to the Liverpool Polytechnic Society, that he should make a communication to them of his process for effecting the same or similar results. But, as we have seen, it was not until the months of August and September that he declared himself prepared to divulge his great secret. And what was it, after all, that he had discovered up to May 8, 1839, allowing him the utmost latitude, on his own representations? Why, not galvanic engraving; not Professor Jacobi's process; etching it might be called, but engraving it certainly was not, his method being to coat copper with etching ground, scratch in a few lines, and make a voltaic deposition of copper, affording lines in relief most assuredly, but lines essentially differing from the lines in relief taken from those "engraved on copper." Mr. Spencer confined the operation to lines engraved, or more properly etched on varnish, laid on copper, (pp. 13, 14.) It is very probable that by a hurried or mistaken reading of the original newspaper paragraph (see the note) he had acquired and was misled by a wrong intimation of the method of following out the hint afforded by that announcement. Mr. Jordan proceeded more ingeniously when, in the early part of the summer of 1838, he produced electrotypes from true "engraved plates," affording, as in Professor Jacobi's experiments, "lines in relief." I cannot refrain from here noticing the marked propriety of Mr. Jordan's style over the swelling pomp of Mr. Spencer's inflated language. The former refers to the *Athenæum* paragraph, and his own experimental researches in galvanism, applied to engraved copper plates, "which (he says) lead me to infer some *analogy* in principle with those of the Russian professor." Mr. Spencer, who ill refrains his contempt for Professor Jacobi, just reverses the foregoing mode of comparison, and says, "I accordingly concluded that *he* was engaged in experiments *analogous* to my own," p. 7.

Before, however, Mr. Spencer could proceed one step, he required some kind of galvanic apparatus; the one he describes at page 12, is repeated at page 13, 14, and he refers to the same at page 19, as that "already described;" nay, his pamphlet opens at page 3, with two diagrams showing the identical battery. Mr. Spencer, as he cannot claim to be the inventor of this highly ingenious and truly simple apparatus, we are prepared (knowing he depreciates all that is not his own,) to be informed on the first notice of his having used it, that he should only—"mention this experiment briefly,—not because it is *directly* connected with what (as he proceeds to say) I shall have to lay before the Society, but because, by a por-

* A pamphlet published under the title of—"*An Account of some Experiments made for the purpose of ascertaining how far Voltaic Electricity may be usefully applied to the purpose of working in Metal. By Thomas Spencer.* Liverpool, Mitchell, 1839, 8vo., pp. 26. Printed for gratuitous distribution."

† The following is the paragraph alluded to, and which also appeared in the *Mechanics' Magazine*, May 11, 1839. "*Galvanic Engraving in Relief.* While M. Daguerre and Mr. Fox Talbot have been dipping their pencils in the solar spectrum, and astonishing us with their inventions, it appears that Professor Jacobi, at St. Petersburgh, has also made a discovery which promises to be of little less importance to the arts. He has found a method—if we understand our informant rightly—of converting any line, however fine, engraved on copper, into a relief, by galvanic process. The Emperor of Russia has placed at the Professor's disposal, funds to enable him to perfect his discovery.—*Athenæum.*"

tion of its results, I was induced to come to the conclusions I have done in the following paper." Now, I say, without fear of contradiction, that *that* apparatus and those experiments were the origin of the whole superstructure of electro-metallurgy, as well in the hands of others, as of Mr. Spencer, of which it is vain attempting any proof to the contrary. Why then treat the matter as so trivial, why endeavour to detract from its value? The answer is plain, the reason two-fold. Mr. Jordan, his rival in the same field, whom he had to humiliate, had used Dr. Bird's apparatus,* and spoken of it most justly as "the form of voltaic apparatus, which exhibits this (the electrotype) result in the most interesting manner, and relates (he says) *more immediately to the subject of the present communication.*" And what better fate could be expected to attend the much envied author of that very neat galvanic arrangement? When he is named, it is not to do him honour by stating that fact, but to affect superiority by ridiculing him for a very possible error in prosecuting the examination of galvanic phenomena; at the same time designating the learned lecturer at Guy's Hospital as "a clever *young* demonstrator (Dr. Bird of London)"—! p. 12.

Mr. Spencer, no doubt, constantly dreaded a powerful opponent appearing in Mr. C. J. Jordan, whose letter of May 22 was published June 8, 1839, entitled "Galvanic Engraving," three months prior to the date of Mr. Spencer's; and when the letter of the one, and the pamphlet of the other are placed in juxtaposition, we trace that similarity of design and execution which surely must be more than the result of sheer accident. Mr. Spencer falls into a long train of coincidences, if such they be, though the natural inference is, that they are premeditated, the offspring of the careful, studious, labour of that long period of mysterious silence from May 8 to September 12, 1839. Mr. Spencer of course endeavours to outstrip Mr. Jordan in every point, (save the date of publication,) and he has a parallel instance for whatever Mr. Jordan adduces of any consequence, so that he cannot even inform us, speaking of the deposited copper, "that the surface in contact with the plate equalled the latter in smoothness and polish," which he "mentioned *to some individuals of his acquaintance*;" but Mr. Spencer must furbish up a story reaching beyond the summer of 1838, and says, "It is two years since I began to experimentalize on this subject, (September 1837.) I *then* made mention of it *to a few friends*, (some of whom are connected with the public press in Liverpool,) but strictly enjoined them not to make it public until the experiments were matured," page 7. Mr. Jordan, in his communication, records the fact of metallic reduction being "an essential feature in the action of *sustaining* batteries." Mr. Spencer, as he could not introduce so important a remark with any feature of novelty, takes another course, and makes no account of it. "I had long been aware," he says, "of what every one who uses a *sustaining* battery with sulphate of copper in solution must know,—that the copper plates acquire a coating of copper from the action of the battery; *but I had never thought of applying it to a useful purpose before*," p. 13. The natural enquiry, then, that suggests itself on hearing his concluding remark is, whether he has not designedly omitted adding, "*before reading Mr. Jordan's letter?*" That seems to be the truth.

On another important head Mr. Spencer has been somewhat troubled by Mr. Jordan's prior publication, wherein he says of the precipitation of copper, that it will be "in a state of greater or less malleability according to the *slowness* or *rapidity* with which it is deposited." As this is too important a point to give up, we are apprised, at the second page of Mr. Spencer's paper, of what is to follow, when he says, in his very first description of the apparatus, "It was intended that the action should be slow; the fluid in which the metallic electrodes were immersed were in consequence separated by a thick disc of plaster of Paris," p. 12. Yet at page 15 he informs us, "*I discovered* that the solidity of the metallic deposition depended entirely on the *weakness* or *intensity* of the electro-chemical action," which he could regulate "by the thickness of the intervening wall of plaster of Paris."

* For a full account of this elementary battery, see the original paper, "Observations on the Electro-chemical influence of long-continued electric currents of low tension. By Golding Bird, F.L.S., G.S., &c." Read Feb. 2, 1837. Phil. Trans., 1st part, 1837. He observes, "To M. Becquerel we are almost entirely indebted for our knowledge of the chemical agency of feeble currents in reducing certain refractory oxides to the metallic state."

Mr. Jordan had found, on separating a precipitated plate from an engraved copper plate, that it exhibited "the most delicate and superficial markings, from the fine particles of powder used in polishing, to the deeper touches of the needle or graver." Mr. Spencer having obtained an impression of a medal, says of the electrotype, "On examination with a magnifying glass, I found every line was as perfect as the coin from which it was taken," p. 19. Mr. Jordan doubts not "casts and moulds may be taken from any form of copper." We find Mr. Spencer "was desirous of executing metallic ornaments by this means, in either cameo or intaglio;" and says of his first essay, "I accordingly determined to make my first experiment on a very prominent copper medal," p. 19. In one experiment Mr. Jordan says, "a common printing type was substituted," by which he formed "a perfect *matrix*, which might be employed for the purpose of casting." Mr. Spencer, in the introduction, or "Prefatory," as he pedantically terms it, to his pamphlet, acquaints us that, "In the formation of that important implement in the manufacture of printing types—the *matrix* or mould—advantages in the adoption of this operation appear (!) to present themselves," page 9. Mr. Jordan very ingeniously observes of the process he describes, that "It may be taken advantage of in procuring *casts* from *various* metals;* for instance, a copper *die* may be formed from a *cast* of a *coin* or *medal*, in silver, type metal, or lead, &c., which may be employed for striking impressions in *soft metals*." Mr. Spencer appropriates this hint, as too natural and too common to be other than general property, and warns us so accordingly. "Being aware," he says, "that copper in a voltaic circuit deposited itself on lead with as much rapidity as on copper, I took a silver coin, and put it between two pieces of clean sheet lead, and placed them under a common screw press," page 20. This experiment of "striking impressions on soft metals" succeeded entirely. Mr. Spencer, in his "prefatory" remarks, lauds the art for "supplying as it does a means of procuring a *cast* or a *die* in hard metal," p. 8; and afterwards for "the applicability of this process, in procuring exact fac-similes of *coins* or *medals*," p. 9; and at length declares, "So complete do I think this latter portion of the subject, that I have no hesitation in asserting that fac-similes of any *coin* or *medal*, no matter of what size, may be readily taken, and as sharp as the original," p. 20. But had not Mr. Jordan said all this before him? Mr. Spencer, p. 21, says, "I now come to the conclusion of my experiments. I took two models of an ornament, one made of clay, and the other of *plaster of Paris*;" one he bronzed, and having gilt the other, he obtained metallic casts from both. Mr. Jordan had before plainly thrown out the hint; and strange enough it happens to be the last suggestion adopted by Mr. Spencer, though it is the last but one in Mr. Jordan's letter, where he says, "Casts may probably be obtained from a *plaster* surface."

Mr. Jordan's concluding proposal appears to have baffled Mr. Spencer, and to have been too uncouth or unmanageable to have excited his attention, most likely arising from the complexity consequent on a misprint (as it appears) of "tubs" for *tubes*, thus, "tubs or any small vessel, may also be made by precipitating the metal around a wire, or any kind of surface, to form the interior, which may be removed mechanically, by the aid of an acid solvent, or by *heat*." The metallic coating on wires would evidently form *tubes*, which Mr. Spencer has thus missed the lucky opportunity of proposing for gas pipes, and recommending to the gas companies! Who can say but it was while thinking how to make *tubs* that he struck out the magnificent idea of coppering ships' bottoms (as he must be familiar, in a seaport town, with the calling of any old vessel a "*tub*,") thus literally supposing "tubs or any small vessel," to be synonymous terms; and which, oddly enough, may actually have led to his preparing the galvanic-coppered model, which was afterwards sent by him to the Admiralty!

Mr. Jordan, as just noticed, recommends the application of "*heat*," as one means of removing the deposited metal but Mr. Spencer ingeniously gets hold of the same idea by finding out that when

* Mr. Spencer varies the reading of this suggestion thus:—"Nor (I need hardly observe) is its application confined to copper only." Prefatory, p. 8. Why "need hardly observe?" except that it had been quite as well observed before him; but then it was by his rival! Every opinion and process of his own, however dull and blundering, is carefully detailed.

plate is varnished to deposit the copper in the clean engraved lines, that on heating the plate to remove the varnish, the whole net-work of copper came along with it. p. 15. Having thus made himself, in this also, an undoubted *discoverer*, and got rid of Mr. Jordan's assistance, he proceeds—"When I wished to take it (the electrotype) off, I applied the *heat* of a spirit-lamp to the back,"—and again,—"When the *heat* of a spirit-lamp was applied for a few seconds to the lead, the copper impression fell off easily." p. 20.

The apologist for Mr. Spencer might pretend to show that discoveries depend on accumulated facts, that all discoveries are made up of what, in some way or other, was already known; with such men it is impossible to argue. It is not pretended that a discourse wants originality, merely because every word of it may be found in a dictionary. What has Mr. Spencer brought forward of consequence in his paper of September 12, that is not found in Mr. Jordan's of May 22, published the 8th of June, that can entitle him to take precedence as a discoverer, or inventor? Nothing. We may allow him, and justly, the praise of effecting some *improvement*. I believe I state correctly, in awarding him the merit of suggesting the use of nitric acid to give the copper-plate a clean surface, when adhesion of the deposited copper is required; the pointing out and distinguishing the effect of any foreign matter, however slight, to prevent adhesion; even pencil lines on a copper-plate having this effect; the using of an etching ground to attach raised lines to the copper through the etched lines, (the present beautiful process of glyphography); the engraving of sheet lead to obtain copper-plates with a surface of the nature of wood engraving; and, probably, the substitution of bronzed or gilt plaster, &c., for metallic casts. Further, Mr. Spencer did *not* go, at that period, unaided by the suggestions of Mr. Jordan. I venture to say, that there is no one who has read Mr. Jordan's letter but will allow, that had Mr. Spencer's writing *never* appeared, electrography would have flourished by following Mr. Jordan's most excellent, clear, and full prescriptions.

Mr. Spencer, shortly after the publication of his foregoing paper, became the compiler of a treatise called "*Instructions for the Multiplication of Works in Metals by Voltaic Electricity*," published by Messrs. Griffin and Co., of Glasgow, 1840, a review of which appeared in the *Mechanics' Magazine*, vol. xxxiii., p. 491. In this pamphlet occurs the very kind of argument Mr. Spencer may be expected to reiterate in extenuation of his unlimited borrowing and appropriating of other men's works and opinions, after passing them rather through a sieve, than refining them in an alembic. He says, as if preparing an argument to exonerate himself from any future charge of plagiarism, "Few who watch the progress of events can doubt, that had this discovery not been made at this present period, a very brief additional time would have brought it under public attention. (!) Scientific facts were all tending towards it. The great discoveries of the last age were being condensed and combined into the elements of learning for this. Trains of scientific thought, which had been long and curiously laid (!) only required the aid of the match (! !) to explode them simultaneously." The reviewer, led away by the apparent "truth and modesty" (to quote his words) of Mr. Spencer's statements, commits himself to the following eulogy: "What have all our most valuable discoveries and inventions been but happy thoughts—but matches suddenly applied to long pre-existing trains." He likewise remarks, "Mr. Spencer did not patent his discovery, but made at once a free gift of it to his country and the world!" Mr. Spencer knew more than the reviewer—he knew better than to patent a recorded discovery, an invention not his own, and wisely confined himself to patenting what he afterwards, perhaps, did discover, a simple branch of its application; his right to which claim, however, I am informed, is, curiously enough, at present a matter of legal contest against him.

Throughout the present attempt to clear up the extremely involved details illustrating the origin of this truly novel, interesting, and extensively useful branch of art, I have been conscious that there is some risk of my appearing in the unenviable light of being actuated by other than the golden rule of giving honour to whom honour is due. Truth being my only aim, I see not why I should succumb to the phantom fear; trusting, as I do, to the right guidance

of honesty of purpose—regardless of consequences under such direction. This second part of my paper I have no alternative but to publish; it has, I have shown, been invited by most unmeaning and uncourteous insinuations on the part of Mr. Spencer, which I trust I have proved to be groundless. His taunt of being able easily to set aside my statements has also induced my going more into detail. To have noticed earlier his unfounded claims, it was thought, would have interfered with some pecuniary interests he might possibly have in the matter. Absence, together with many pressing engagements, farther prolonged the period of my attention to this part of the subject, until it was forced on my notice by the circumstance first named, of an accidental reference to the volumes of the *Mechanics' Magazine*. Every plea for continued silence has, after a lapse of four years and a half, entirely subsided, were I to except, indeed, an intimation that I may expect, for any protest entered against his invalid claims, a heavy shower of abuse from the subject of this memoir; of which the small dark cloud does indeed already appear in the horizon. But in vindicating the cause of Mr. Jordan, is not the cause of justice and of science equally blended? Have I advanced one vulnerable point which can cast the claims of Mr. Jordan into the shade, to the resuscitating of Mr. Spencer's perishing fame? And if Mr. Spencer can, as he asserts, overturn my strictures, is it not highly blameworthy his delaying to unfurl his promised banner of victory?

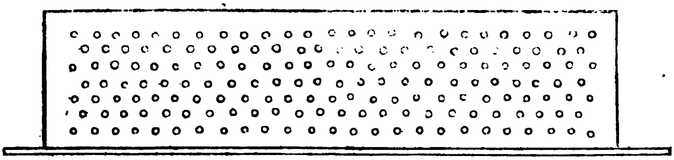
If the writer may now be allowed to say a word for himself, he would observe that in what he has written he has no personal motives of any kind whatever to serve, other than, as now, taking all justifiable means to show that he was prepared with full and sufficient evidence for whatever he has advanced. The facts stated have long been before his mind, and in choosing the present time and manner of making them public he considers it fortunate his doing so during the lifetime, he believes, of all the parties interested; than which he can offer no better proof of not shrinking from the test of enquiry. It is besides his intention, at a future period, to give in another form his present views of the history of electro-metallurgy, when he would not wish to stand alone as at present, differing from all preceding writers; it is therefore desirable to have the matter early set at rest. If Mr. Spencer feels aggrieved, of which his latest letters certainly afford evidence, he should seriously reflect that, as his laurels are being stripped from his brow, it behoves him to occupy that time in vindicating his now disputed claims, which he is infelicitously wasting in maligning him who will be foremost, on the successful issue of such an event, to atone as best he can for (in that case) a great wrong done to a great genius.

77, King William-street, City. February, 1844.

STEAM PRIMING PREVENTOR—JOB ALLEN, OF PRIMROSE-STREET, BISHOPSGATE-STREET, ENGINEER, PROPRIETOR.

[Registered under the Act for the Protection of Articles of Utility.]

Fig. 1.



Description.

Fig. 1 is an elevation of the preventor unattached. It consists of a small perforated box, of metal, or any other suitable material, which is to be attached to the receiving end of each pipe which leads from the boiler of a steam-engine into the steam-chest, and also to the receiving end of each pipe which leads from the steam-chest into the engine-cylinder or cylinders. By passing through this box, any water which may rise along with the steam is arrested, and thrown back into the boiler.

Fig. 2.

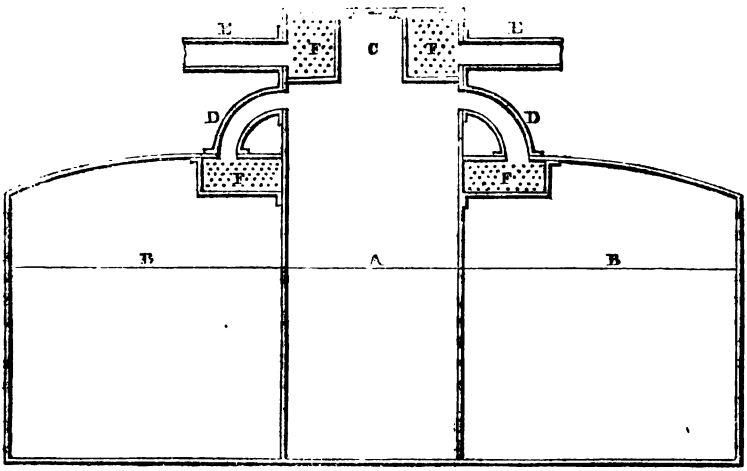


Fig. 2 is a sectional elevation of a set of marine engine boilers, with four of these very simple, and, we doubt not, efficient preventors applied to it. A is the middle boiler, and B B the two wing boilers; C the steam-chest; D D the pipes by which the steam is introduced from the wing boilers and the steam-chest; E E are the pipes which conduct the steam to the engine cylinders; F F F F are the four priming preventors.

ON CELESTIAL MAPS—IN CONTINUATION OF THE ARTICLE IN VOL. XXXIX., P. 453.

C. Argelander (D. Fr.) New Uranometria. "The stars visible in Europe to the naked eye, laid down in their true magnitudes from actual observation." Small folio, Berlin, 1843.

This work resembles Schwinck's in several particulars; in the scale, the projection, and the mode of exhibiting the configurations. It is inferior to it as not including stars below the sixth magnitude, and as wanting the reticulation of degrees. Argelander divides into 16 portions what the other comprehends in 5; these maps are consequently the most portable. But the important feature is, that they exhibit *all* and *only* the stars visible to the naked eye, and that ·eir *gradations of brightness have been refully discriminated by recent and stematic observation.* They are fur- er distinguished by interpolation of the ale of magnitudes in an accompanying mpact octavo catalogue.

For more than a century this has been desideratum. The late Sir W. Herhel, fifty years ago, began an exact imation of the brightness of stars, but t it unfinished; and until within twenty s the inaccurate magnitudes of the Britannic Catalogue retained their stations on globes and maps. More recently, Piazzi's catalogue became the chief authority; not, however, without strong doubts of its accuracy in regard to many stars. In fact the determination of magnitudes should properly be a distinct undertaking from that of positions; and this is the course which Professor Argelander has pursued during more than four years. The result has been the work now under consideration.

Piazzi's catalogue contains 7646 stars, the whole of which are inserted in the large maps of the Useful Knowledge Society, together with a few from Bessel's "Astronomiæ Fundamenta." Although more than half of these are telescopic, yet it would be a mistake to suppose that none visible to the naked eye are wanting. Argelander's new catalogue contains (for the epoch 1840) 3287 stars, down to 36° south declination, of which number there are not found in Piazzi or Bessel 708—a large deficiency, of which the amount is now first ascertained.

Argelander's Atlas and Catalogue ought to be forthwith republished in this country.

J. W. WOOLLGAR.

PROGRESS OF SCREW-PROPELLING.

The *Prometheus* and *Rattler* are two sister vessels, which our readers may remember, were some time ago built by order of the Admiralty, for the special purpose of testing the comparative capabilities of the common paddle-wheel and the screw, when worked under circumstances as nearly alike as possible. The *Prometheus* is fitted with paddle-wheels, and the *Rattler* with a screw, on what is called Smith's plan. Both vessels have engines of 200 horse-power, and both are laden so as to have the same draught of water, viz., 11 feet 3 inches. On being repeatedly tried against each other over the measured distance in Long Reach, it has been found that the *Rattler* and screw have decidedly the advantage. The speed attained by her has been 9·240 knots, or about 10¾ miles an hour, while the greatest speed of the *Prometheus* has not exceeded 8·757 knots. When we hear, however, of Thames steamers doing 12, 14, 15, and even 18½ miles an hour, as attested by Messrs. Napier, in the letter from them, which follows this article, the *Prometheus* must be considered but an indifferent representative of the propulsive power of the paddle-wheel. It may indeed be said, on the other hand, that neither has the *Rattler* shown all that the screw is capable of, since the *Mermaid* of the Messrs. Rennie (now H. M. S. *Dwarf*) accomplished, with a sort of screw, different from Smith's, 12 miles an hour.

Mr. Woodcroft has the promise of the Admiralty that his form of screw (see *Mech. Mag.* vol. xxxix., p. 293) shall have a trial in the *Rattler* after Smith's, and it would be but fair that every other form which offers any prospect of success should have a like opportunity afforded to it.

At the Institution of Civil Engineers, on the 13th inst., Mr. Grantham gave a detailed account of his experiments with the iron vessel called the *Liverpool Screw*. The vessel is 65 ft. long, 12 ft. 6 in. beam, and her draught of water 3 ft. 9 in. She is propelled by two high-pressure oscillating engines, with cylinders thirteen inches diameter, and eighteen inches stroke; the pressure of the steam in the boiler varied during the experiments from 50 lbs. to 60 lbs. per square inch, and it was cut off at one-fourth of the length of the stroke, working the remainder by expansion. The cylinders are placed diagonally, with both the piston rods working upon the same crank, the driving shaft being beneath the cylinders, and running direct to the propeller, without the intervention of either gearing or bands. The screw propeller is 5 ft. 4 in. diameter, by 20 in. in length, and set out with a pitch expanding from 10 to 11 feet on Mr. Woodcroft's plan; it has four short arms with broad shovel ends, whose united area is 16 square feet, but 13 feet only was immersed, as some portion of the arms was constantly above the water; the angle of the centre of the float was 45°. The speed of the propeller was generally ninety-five revolutions per minute. With these dimensions, the speed attained was described as ten and a half statute miles per hour, being less by a quarter of a mile than the speed of the *Rattler*. The amount of "slip" of the screw in the water, as ascertained by Massey's log, was stated not to exceed 5 per cent. Several experiments were detailed, which showed that there was not more tendency to "list," or to turn round by the action of the screw, than with paddle-wheels, and the vessel was said to have excelled all the other steamers of the port of Liverpool in towing out vessels in a rough sea.

At the same meeting M. Normand, the eminent French ship-builder of Havre, gave an account of the *Napoléon*, French steam frigate, to which a screw has been applied, but frankly admitted that the speed was inferior to what had been obtained by paddle-wheels.

The "Genevese Traveller" gives, in one of his admirable letters to the *Times*, the following interesting account of the American war-steamer *Princeton*, to which Captain Ericsson's propeller has been applied.

"A great object of interest to our citizens at this time is the United States war-steamer *Princeton*, just built under the superintendence of Captain Stockton, which now lies in this harbour, and is daily visited by crowds of interested spectators. This steamer is constructed with Ericsson's propeller. Its steam machinery is placed entirely below the water line, out of the reach of shot. Its engine is extremely light and simple of construction, occupying only about one-eighth of the bulk required by the ordinary British marine-engine of the same power. It gives a direct motion to the axis of the propeller without the aid of cog-wheels or auxiliary gearing of any description. It is styled the semi-cylindrical steam-engine, and is the invention of Captain Ericsson. For the vast power which it includes in so small a compass, and for the exquisite symmetry and proportion of all its working parts, this engine is the theme of general admiration. The armament of the *Princeton* includes two huge wrought-iron guns (introduced by Captain Stockston), placed one at each end of the ship, the largest weighing ten tons, and with a bore of 12 inches, carrying a ball of 213 lb. This gun is placed on a wrought-iron carriage, also contrived by Captain Ericsson, and which, without the use of the ordinary breeching,

checks the immense recoil, and the vessel suffers but a very slight shock from the discharge. By means of this carriage this huge gun is managed by half-a-dozen hands with perfect facility. The peculiarity of the steam-machinery of the *Princeton*, and its being placed out of the reach of shot, are supposed to give her obvious advantages over all other steamers now afloat intended for naval warfare."

THAMES STEAMERS—THE "ISLE OF THANET."

Sir,—In your Magazine for last month, we observe a letter signed "John Barnes," referring to a trial which the *Prince of Wales* had with the *Isle of Thanet* on the 25th of August last. We believe it is correct so far as it goes, but for the information of such of your readers as may take an interest in the subject, we think it right to add that, on that occasion (as must have been apparent to any one on board the *Prince of Wales* at all acquainted with the relative speeds of the river steamers,) the *Isle of Thanet* was not going much above half speed. On account of a derangement in the machinery, the engine was only making from 32 to 35 strokes a minute, instead of 44. The *Isle of Thanet* has obtained a speed of 18½ miles per hour, which we believe is 1½ miles more than that of any other steamer in this country.

We remain, Sir, your obedient servants,

J. AND F. NAPIER.

Millwall, February 15, 1844.

PROGRESS MADE IN THE APPLICATION OF ELECTRICITY AS A MOTIVE POWER.

A lecture on this subject was delivered by W. R. Grove, Esq., at the Royal Institution, on the 9th inst. Mr. Grove gave — 1, a brief summary of the laws of the electro-magnetic force; 2, a description of the chief modifications of the engines to which that force has hitherto been applied; 3, the commercial statistics of its application; and 4, a view of the purposes for which this power is available. In dealing with the first of these subjects, Mr. Grove exhibited, by many illustrative and successful experiments, the well-known re-actions of iron and other metals on each other, when exposed to the influence of an electric current. The actual application of these familiar phenomena was then shown in the working models of several machines, which were set in action by the nitric acid (or Grove's) battery, invented by Mr. Grove. These machines he divided into three classes: First, those acting by the immediate deflecting force, as shown in the galvanometer, Barlow's wheel, &c. Second, those on what is called the suspension principle, in which two powerful electro-magnets are fixed contiguous to the periphery of a wheel, and in the line of its diameter, plates of soft iron being fastened on this periphery at short and equal intervals. The electro-magnets are so arranged as to lose their attractive power as soon as they have drawn through a given space each plate of iron, necessarily presented to them by the revolution of the wheel, but are immediately afterwards reinvested with this power, in order to operate on the next plate. By these means the wheel is kept in constant rotation on its axis. The third class of electrically-driven machines are applications of the principle of Ritchie's revolving magnet. In these, an electro-magnet, balanced on a pivot, so as to rotate in a horizontal plane, is arranged between the poles of a permanent magnet. Hence, the alternate attractions of the opposite magnetic poles, combined with its own momentum, cause the electro-magnet to continue rapidly revolving. Mr. Grove proceeded to his third subject, the commercial statistics of electro-magnetic power. It appears, by the experiments of Dr. Botto, that the consumption of 45 lbs. of zink will produce an effect equivalent to a single horse power, for twenty-four hours. The cost of the metal, at 3*d*. the pound, would amount to 11*s*. 3*d*. About 50½ lbs. of the nitric acid of commerce would be required to dissolve the metal in the most economical and effective manner. The charge of this, at 6*d*. the pound, would be 1*l*. 5*s*. 6*d*. The whole expense, therefore, of obtaining the effect of a one-horse power by an electro-motive apparatus, would be 1*l*. 16*s*. 9*d*. In this calculation the cost of the requisite sulphuric acid is assumed to be fully covered by the value of the salts of zink produced in the operation. The same amount of power produced by a steam-engine would not cost more than a few shillings. Mr. Grove explained that this comparative costliness of the electro-magnetic machines resulted from the sources of their force, zink and acid being manufactured, and consequently costly articles, whereas, coal and water, the elements of the steam-engine's force, were raw materials, supplied at once from the earth. Mr. Grove took this occasion to observe, that the experiments of Botto, just alluded to, were made with his (Grove's) battery; and that upon the cost of the constituents of this, the calculations were founded. At first sight, this battery would appear a dear form, from the expense of the nitric acid; but a little consideration proves the contrary of this. Compare it, for example, with a battery merely charged with dilute sulphuric acid (the cheapest possible electrolyte), to perform an equivalent of work, (as the

composition of a given quantity of water,) a series of three cells of the ordinary battery is necessary; hence the consumption of three equivalents of zink, and three of sulphuric acid. But the intensity of the Grove's battery is such, that the same resistance can be overcome by one cell, consuming only one equivalent of zink, one of sulphuric acid, and one-third of nitric (there being in this acid three available equivalents of oxygen). Independently of this smaller consumption, Mr. Grove's battery has the advantage of occupying only one-sixteenth of the space of the other constructions.

In concluding his communication, Mr. Grove mentioned the two well-known applications of electric power—the electric telegraph and the electric clock. To neither of these can steam, or, indeed, any known force, be so applicable as that which travels with a greater velocity than light itself.

THE EARL OF DUNDONALD AND H. M. STEAM FRIGATE "JANUS."

The *Janus* is a new steam frigate, which the Lords of the Admiralty have had built under the immediate superintendence of the Earl of Dundonald; and which his lordship has been allowed to do what he pleased with, as well with respect to her architectural construction, as to the machinery by which she is to be propelled. The Earl must be allowed to have amply availed himself of the *carte blanche* given him. The *Janus* is like to nothing else which is or ever was afloat. She has two bows and no stern; that is to say, she is bow-shaped at both ends, so as to be capable (it is said) of moving in either direction with equal facility (whence the name *Janus*, which is typical of looking forwards and backwards); and has two rudders, two capstans, two pairs of hawser-holes, all to match. The steam-engines are neither of the old beam sort, nor yet of the direct-action kind, which have of late come into vogue; but of that will-o'-the-wisp class, the rotary, the history of which has been so uniform a history of failures, and which, in the judgment of a great majority of the engineering world, is so radically fallacious in principle, that it is impossible it ever can succeed. Lord Dundonald took out a patent for the particular plan of rotary engine which he has adopted in the *Janus* about ten years ago (Dec. 20, 1833), and the reader who is curious about it will find a full description given in our journal of the 20th December, 1834 (No. 593).

Were the patronage of the Admiralty generally distinguished for the liberal and impartial spirit with which it is administered, we should have been the last to find fault with the large portion of it which has in this instance fallen to the lot of so brave and meritorious an officer as the Earl of Dundonald (better known as Lord Cochrane); but when we reflect on the notorious niggardliness of their lordships to inventors—on their habitual refusals to be at a shilling of expense for the trial of inventions, however well recommended by competent judges to their notice, or however palpably deserving of encouragement—and on the very great number of promising plans which the *one large sum* involved in the *carte blanche* granted to Lord Dundonald would have sufficed to test the value of—we must confess that we are filled with astonishment, and think there is abundant cause for complaint, that the Board should have sanctioned the expenditure of so many thousands of the public money on schemes of so speculative and questionable a character as those of Lord Dundonald.

The cry of all the dockyards is, that the double-bow plan can never possibly answer. On this point we offer no opinion of our own; but we may be excused for asking whether their lordships, in determining to give it a trial, followed their own judgment, or the judgments of those best qualified to advise them on the subject?

The rotary engines we may register at once as a certain failure. We do not mean to say that they will not show good results on a first trial, or even some half-a-dozen trials; but we question utterly the possibility of their doing, for a continuance, more work at the same cost as the direct action reciprocating engine. If the Admiralty Board had been sincerely desirous of giving the rotary principle a fair trial, without regard to persons or parties, they would have advertised for tenders for the best engines on that principle. And if they had done in this, as in other cases, they would have insisted on the party whose tender was preferred, finding sureties that the Government should be no losers by the experiment. Before Messrs. Seaward and Co. were allowed to put their first set of engines on the Gorgon plan on board, they were obliged to find sureties to the extent of some 20,000*l.* or 30,000*l.*, (we forget the exact sum) that if they did not answer, they should be taken off the hands of Government, free of expense. For how much, may we ask, has Lord Dundonald been compelled to find bondsmen?

There is a tailpiece to this little incident in the history of steam navigation, which is *quite of a piece* with all the rest. Lord Brougham—that distinguished nobleman of-all-work—has brought a Bill into the House of Lords for extending the fourteen years' term granted to Lord Dundonald by his original letters patent for the exclusive use of his rotary engine, to some further period,

left blank in the Bill. By the existing law of the land, the Privy Council is empowered to give an extension of not more than *seven* years. Lord Dundonald and his friends consider this to be not enough; they must have another fourteen years at least, and therefore it is they have brought in their Bill. We think they are modest to an excess. We feel quite certain that if they had proposed to extend the term to *for ever and a day*, such is the opinion of the best practical engineers of the value of Lord Dundonald's rotary engine, there would not have been a single one to say "Nay." But even supposing the case were the reverse—why not wait a little, till this best of all rotary engines is tried? Why take advantage of the mere *order* for a trial? Why not wait till the trial is actually made? The patent has yet almost four years to run, so that however other things may press, time does not. Is there any company project in embryo depending on a *prima facie* case being made out? Lord Brougham, as "of counsel" to the woolsack, will of course see to it.

THE FOUL WATER NUISANCE—STUCKEY'S PATENT FILTER.

Sir,—Last year you had several excellent articles in your journal on filtration, and it appears that the views you expressed of the value and utility of Mr. Stuckey's filter have produced fruit, as it is evident that the inhabitants of the populous borough of Lambeth refer to that invention in the petition which I enclose, which is receiving, I believe, multitudes of signatures. Though filtration cannot entirely *purify*, still, as a professional man, I am convinced it would materially diminish the injurious effects at present experienced; and the attention you formerly paid to the subject I trust will be sufficient apology for having taken the liberty of bringing it under your notice again.

I am, Sir, your obedient servant,

G. W. BLANCH, Surgeon.

3, Vassall-place, Brixton-road, Feb. 14, 1844.

[From the petition transmitted along with the preceding communication, which we regret we have not room to give at length, appears that by a clause in the Act of incorporation of the Lambeth Water Works Company, it is declared that "it shall not be lawful for the said Company to supply any house or houses with any water from the river Thames *without having previously effectually purified the same by means of filtration*;" but that this most salutary provision has become a dead letter from the same cause which has rendered the existing statutes for the prevention of smoke so inoperative,—namely, the omission to fortify it with suitable penalties. The consequence is alleged to be, that the water supplied by the Company is "foul and filthy, having animalculæ, insects, decomposed vegetable and animal matter, the refuse of gas-works, the contents of common sewers, and various other unhealthy and disgusting abominations mixed with it." The petitioners pray that the House will be "pleased to enquire into the truth of these allegations," and take measures to remedy the grievance complained of.

We observe from the newspapers, that the parish of Bermondsey has adopted a similar petition; and that the inhabitants of Southwark, Deptford, and Greenwich are also bestirring themselves on the subject.

The *West Kent Guardian* very pertinently observes, "The (Greenwich) Railway Directors filter their water in order to save their engines from speedy corrosion and destruction; but, though ruinous to iron, it seems the same water is good enough for flesh and blood." The same paper adds, "We hear that there has been some talk among our Water Company, as to the expediency, or rather necessity, of adopting the new system of filtration (Mr. Stuckey's) which has been so highly spoken of in Parliament by Lords Brougham and Radnor; but as it would cost for all the inhabitants of the Borough just about twice the amount it costs the Railway Company for their engines alone, it seems that selfishness has hitherto prevailed over humanity."—ED. M.M.]

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The Artists' and Amateurs' Magazine (Rippingale). No. 11. 1s.

Pharmaceutical Journal and Transactions (Bell). 1s.

The London Polytechnic Magazine. Edited by Thomas Stone, M.D. No. 2.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 5 AND 6 VIC. CAP. 65. FROM 24TH JANUARY TO 21ST FEBRUARY, 1844.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
Jan. 24.	113	William Palmer	144, Western-road, Brighton	Vertical filter.
30	114	John Bruce	Tiddington, near Stratford-upon-Avon	Skim or stubble plough (improved).
Feb. 8	115	George David Doudney	17, Old Bond-street	Scales.
9	116	James Milne and Son	Edinburgh	Sliding tubes, or what are called water-joints, for lowering or raising gas pendants (improvement.)
10	117	Allen and Moore	131, Snow-hill, Birmingham	Gold coin gauge & weight.
12	118	Peter Robertson & John Todd	67, Mitchell-street, Glasgow	Spring and axle box, proper for railway and other carriages.
13	119	Alexander Wilson	22, Milk-street, Cheapside	Windsor parasol.
14	120	Alexander Burton	2, Norfolk-place, Glasgow	Letter-printing press.
19	121	Alexander Stiven	86, Drake-street, Rochdale	Simple and compound parallel vice (improved).
,,	122	Job Allen	Primrose-street, Bishopsgate-street	Steam priming preventer.
20	123	Robert Mitchell	Portobello-street, Sheffield	Screw auger with four cutters.
,,	124	Richard Roberts and Co.	Globe Works, Manchester	End frame of a power loom.
,,	125	Benjamin Fowler	Dorset-street, Salisbury-square, London	Hot-water circulator.
,,	126	Thomas Wolferstan	Salisbury	Tap or cock (improved).
21	127	Fletcher Woolley	180, High Holborn	A design for improvements in the shape and configuration of lamps and appatus connected therewith for the burning of oil, of turpentine, camphine, naphtha, resins, naphtha, oils, and similar combustibles, parts of which improvements are applicable to other puposes.

LONDON: Printed and Published by James Bounsall, at the Mechanics' Magazine Office, No. 166, Fleet-street.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; and W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1073.] SATURDAY, MARCH 2, 1844. [Price 6*d*.

Edited by J. C. Robertson, No. 166, Fleet-street. Double.

MAUDSLAY'S SCREW-PROPELLING MACHINERY.

Fig. 1.

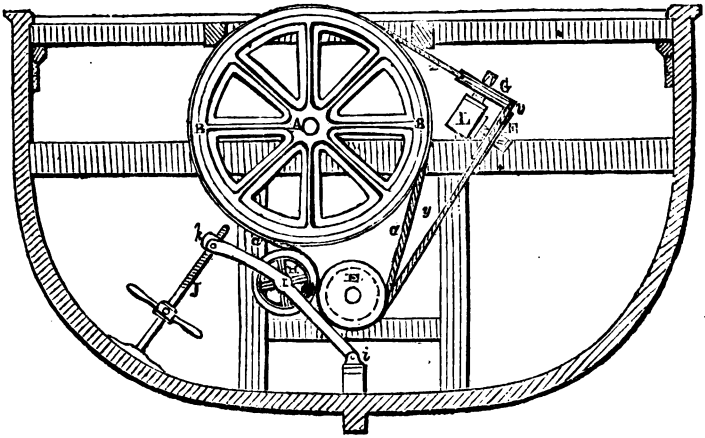
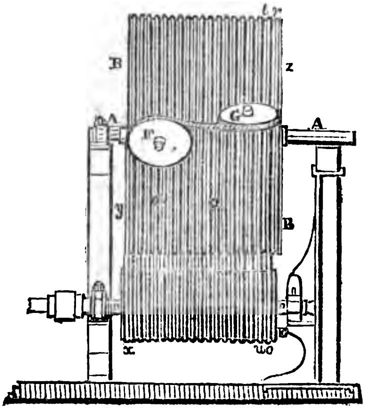


Fig. 2.



MR. MAUDSLAY'S PATENT IMPROVEMENTS IN SCREW-PROPELLING MACHINERY.

[Patent dated, July 13, 1843; Specification enrolled, January 13, 1844.]

The improvements which form the subject of this patent consist, *firstly*, in a new mode of communicating "rapid rotary motion from the steam-engine or engines to revolving propellers of the kind which have been hitherto usually denominated screw propellers;" and *secondly*, in a new arrangement of the propelling and steering parts of the machinery of screw-propelled vessels.

The principal difficulty which is now commonly supposed to stand in the way of the more general adoption of screw propellers is that which arises from the great difference between the speed at which the cranks of the engines move, and that which it is deemed necessary to give to the screw shaft. Some have tried to get over it by interposed wheel-work, others by plain drums and bands; but the former is complained of on account of the great noise made by the wheels, and their extreme liability, under severe strains, to irremediable damage; and the latter, though less noisy, are objected to on account of the liability of the bands to slipping and sudden disruption. Others again, with Mr. Grantham at their head, contend that the speed of the screw shaft may be reduced to a conformity with that of the engines by enlarging the diameter of the screw,* and that the power of the engines may then be communicated directly to the shaft. Mr. Maudslay contents himself for the present with improving the drum and band plan, so that it shall not only be as nearly noiseless as possible, but free from all risk of failing from the causes stated. Instead of plain drums, he makes use of grooved drums, and instead of passing the band once round the drums, he passes it many times round them in the grooves provided for the purpose. Fig. 1 of the accompanying engravings represents a transverse vertical section of a steam-vessel, with the screw-propelling machinery arranged on this plan; and fig. 2, a longitudinal vertical section of the same. The following detailed description we extract from Mr. Maudslay's specification:—

"The axis of the crank, or cranks, of the steam-engine, or engines, is disposed parallel to the lengthways of the vessel, and that axis is prolonged by another axis, A A, disposed in the same line with the axis of the crank or cranks, and on that prolongation A A, a large cylindrical drum, B B, is fastened, having a number of grooves around its circumference suitable for receiving an endless rope, *a a*. The axis of the propeller (or rather a prolongation of that axis, represented by D D) is parallel, or nearly parallel, to the axis A A, and a small cylindrical drum, E E, is fastened on the axis D D, having grooves around its circumference, corresponding to the grooves around the large drum B B. The endless rope *a a* is carried over the large drum B B, and under the small drum E E, with a series of convolutions around the two drums, in the grooves of each drum respectively. To trace the course of the endless rope, it may, for the purpose of description, be supposed to commence by being passed over the large drum B, fig. 2, in the endmost groove, *r*, thereof, or that groove which is nearest to one end of the drum. Then the rope is carried down under the small drum E, in the endmost groove *s*, of that drum; then the rope is carried up again over the large drum B, in the endmost groove but one, *t*, of that drum; then down again under the small drum E, in the endmost groove but one, *u*, thereof, and so on; the rope being carried round the two drums with succeeding convolutions, enveloping both drums in each convolution, till it passes under the last groove of the small drum at *x*, whence the rope is carried upwards, in an inclining direction at *y* (see also fig. 1), to a leading pulley F, over which it makes a quarter turn, and is carried, in the direction of the lengthway of the drums, at *v*, to another similar leading pulley, G, under which it also makes another quarter turn, and thence is carried upwards, in an inclining direction, *z*, to the endmost groove, *r*, of the large drum B, where it has been supposed, for the purpose of description, that the convolutions commenced. The leading pulleys F and G are disposed with their axes in inclining directions, and so placed as that the endless rope, in proceeding towards or away from the circumferences in the direction of the tangents thereto, will be in the planes of the endmost grooves of the two drums; for instance, when the rope is proceeding upwards in an inclining direction at *y*, from the endmost groove *x*, of the small drum E, that inclining direction *y*, is a tangent to the pulley F. And so the inclining direction *z*,

* See a notice on this subject in a subsequent page of our present Number.

of the rope, in proceeding to the endmost groove, *r*, of the large drum B, is a tangent to the pulley G. And in passing at *v* from the leading pulley F to the leading pulley G, the rope makes its return all at once in the direction of the lengthways of the drums, from being opposite to one end of each of the two drums at *x*, to become opposite to the other end of each of the two drums at *r*; and thus by such return counteracting the effect of all the progress that the rope makes contrariwise along the said lengthway of the two drums, in making its successive convolutions around them, and progressing at each such convolution from each groove of each drum to the next adjacent groove thereof in the manner already described. And in order to give a proper tension to the endless rope, so that it may apply itself properly in the grooves of the two drums, and avoid slipping therein, another small drum (H, fig. 1, which may have grooves around its circumference corresponding to those around the small drum E, is applied with its axis in a direction parallel to that of the two drums B and E, so that its circumference will bear against the endless rope at one part of each of the several convolutions thereof, so as to bend the rope into the space between the large drum B, and the small drum E, with more or less of deflection from the straight direction that the rope would assume in passing from the grooves of one of those drums to the corresponding grooves of the other of those drums, as would be the case if there were no such bending action by the drum H, in order by such bending to give the requisite tension to the rope. The pivots at the two ends of the drum H, are mounted in bearings formed in two levers, whereof one is shown in fig. 1, at *i*, I, *k*, the fixed centre of motion for that lever being at the end *i*, and the bearing for the pivot of the drum H being near the mid-length, and at the extreme end *k* of the same lever a bar extends from it across, in a horizontal direction to the corresponding end of the other lever at the other end of the drum H, which other lever is similar to that which is represented, and has the bearing for the other pivot of the drum H, near its mid-length. The said bar, which extends from the extreme end *k* of one the said levers to the corresponding end of e other of them, unites these two levers to a sort of movable frame, wherein the um H is included, and by which it is susined, with liberty to turn freely round pon its pivots at each end of it, and a screw is applied to the said bar, which extends om one lever to the other, in order to susin the said movable frame and the drum H, id so as to raise or lower the same by turning the screw J, and by that means to cause the drum H to bear with its circumference against the rope, in order that it may bend the rope less or more into the space between the large drum B and the small drum E, as may be required, in the manner already mentioned. The said bending of the rope will cause it to apply around a greater portion of the circumference of the small drum E than would be the case without such bending; and there is one such bending in the rope for each of the convolutions that it makes around the two drums B and E, and by turning the screw J from time to time, so as to give more and more of such bending, the proper tension of the rope can be kept up, although the rope may be stretching, and gradually increasing in length, in the course of continual working. When a new rope is put on, it should have the two ends spliced, or united together, so as to form an endless rope of such length that the several convolutions of the rope will apply with a proper tension around the two drums B and E, to avoid slipping in the grooves thereof, without requiring much of the aforesaid bending of the rope by the drum H at first; but as the new rope extends in length by stretching, in working, the screw J must be turned, so as to raise the frame wherein the small drum H is mounted, in order to bear that down against the rope, until it bends the same as much as may be requisite for keeping the rope to a proper tension,—such regulation by the screw J being repeated from time to time, and gradually, but as fast as the rope may (by its stretching) have a tendency to diminish in its tension, so as, by means of the screw J, to counteract that tendency. And when the rope has lengthened so much as to require all the bending that the drum H can produce, in order to keep up the requisite tension, then the rope must be shortened at its ends, and those ends united together again, so as to restore the endless rope to its original length, when, as already mentioned, it will not require much bending by the drum H, in order to produce the requisite tension."

II. In the vessels hitherto constructed with screw propellers, these propellers have usually been placed in an opening in the dead wood, *before* the stern-post to which the rudder is applied; and the circumstance of the rudder coming in the wake of the screw has been supposed to be disadvantageous to the action of both instruments. Mr. Maudslay proposes to fix the screw *behind* the stern-post, that is, in the position now occupied by the rudder; and to substitute for the

ordinary single rudder two rudders placed beneath the stern-quarters, out of the way, and a little in advance of the propeller. Motion may be given to the shaft in this case either by the improved mode before described, or by any of the ordinary methods:—

"Each of the two rudders is an upright cylindrical axis of iron, which passes down through the interior of an upright tube of metal, fixed securely in the vessel by the upper end of the tube ascending through the deck, and the lower end descending through the side of the vessel, where her quarter overhangs, and both ends of the said tube being securely fastened with water-tight junctions to the deck, and to the vessel's side, around the extreme of each end of the tube. The lower end of the upright axis of each rudder is enlarged to form a broad thin blade of any suitable form for acting in the water in the manner of a rudder. Part of the surface of such blade may be *before* the central line of the axis, but the larger and chief part must be abaft, or behind, that central line. The blade is made thin edgewise, in order that it may pass easily through the water. At the borders, and lower part of the blade, the edges are as thin (for cutting edges) as strength will permit, and the thickness increases very gradually from the borders inwards and upwards towards the upright axis part, to acquire such a thickness as is requisite at the upper part for an effectual junction of that part with the upright axis, which, as well as the said junction, must have adequate strength for sustaining the blade firmly in the water by means of that axis, and in consequence of the same being fitted into the interior of the tube *e e*, at the upper and lower ends thereof, but with liberty of turning freely round in that interior for the purpose of steering the vessel. The upper end of each axis ascends above deck through the upper end of the tube, and a lever or tiller is fastened on that upper end of each axis for turning the same, and consequently turning the blade at the lower end thereof, in the water, for steering.

"The two rudders may be used in concert for so steering; for although each one will produce its own effect of steering, independently of the other one, it may be preferred to employ both of them with concurrent effect, which may be done by moving the tillers of both rudders in like manner, at the same time; and for convenience of doing so the two tillers of the two rudders may be connected together at their foremost ends, or at their aftermost ends, in case they are tillers which go backward from their axis, by a link extended horizontally across from one of those foremost (or aftermost) ends to the other of them, and jointed to both those ends, and then any turning motion which may be given to one tiller and rudder will be equally given to the other tiller and rudder."

Mr. Maudslay lays no claim to the application of two rudders beneath the stern-quarters of a vessel for the purpose of steering, "except when used in combination with a screw propeller or propellers."

MR. HAM'S SPECIFIC GRAVITY INSTRUMENT.

Sir,—I am at all times most happy to receive suggestions for improvement; and am therefore obliged to your correspondent "H. O." The only objection to his graduation of the scale of my specific gravity instrument is, that in practice he would find it very difficult to obtain the same degree of accuracy as by my arrangement; for instance, supposing that the distilled water was above the zero mark suggested, and the ether proportionally above ·75 (·725 ?), by opening the cock and allowing both to descend until the surface of the water cut the zero point, the surfaces of the two fluids at *a* would be above the mark, and in adjusting those surfaces, the exact zero point,—or surface of the water in the tube,—would be altered; so that two, three, or perhaps more adjustments would be required before the surface of the water at *a* and the zero point would be simultaneously exact. Again, supposing the above two points in the water column to be attained, any subsequent alteration required to bring the surface of the ether, or other fluid, on a level with the mark *a*, would immediately alter the adjustment of the water. Moreover, when the fluids are nearly of the same gravity, much greater accuracy can be obtained by having both as near the top as possible; for the differences are greater, the larger the column.

The ends of the tubes may be turned up bringing them to the same level, and, after the tubes are filled, withdrawing the glasses; but the results are not so accurate as can be obtained by the plan first published, though they may do for some common purposes.

I am, Sir, yours very respectfully,

F. HAM.

Norwich, 22 February, 1844.

LONDON FIRES IN 1843—BY MR. W. BADDELEY, C. E., INSPECTOR OF FIRE EXTINGUISHING MACHINERY.

"Now, 'mid blazing rafters falling,
Screams of woe are heard appalling,
Each upon the other calling;
Heaven like a furnace glowing—
Wind from every quarter blowing;—
Beams are dashing—windows crashing—
Mothers moaning—children groaning—
Sight appalling!—Ruins falling.
All is haste, escape, and flight,
Bright as the glare of day, the dead of night."—*Translation from Schiller.*

"The statistics of London fires are by no means devoid of interest, and the time may come when they will form an index to the social advancement of the people; for in proportion as houses are built more and more fireproof, and habits of carefulness get more and more diffused, the number of destructive fires will assuredly lessen."—*Knight's London.*

During the past year, 749 fires have occurred in the metropolis; at least, this is the number that have been known to and attended by the firemen. There is every reason to believe that twice that number would not give the sum total of these accidents. It is quite clear, however, that the unknown must, of necessity, have been of an exceedingly trifling and unimportant character, otherwise they would have "come to light."

As compared with the previous year, there is a decrease of 20 in the number of fires; there is an increase, however, on the decennial average, of 172.

In connexion with this apparent increase of fires it should be borne in mind, that since the establishment of the Fire Brigade, nearly 750 new streets and squares, containing 45,000 houses, have been added to the districts under their protection; and that the increase of fires is not proportioned to the increase of population.

The particulars of last year's fires are as follow:—

MONTHS.	Number of Fires.	Number of Fatal Fires.	Number of Lives Lost.	Chimneys on Fire.	False Alarms.
January......	73	2	2	9	7
February	57	3	3	13	5
March	58	0	0	8	5
April	55	2	2	8	5
May	53	2	3	6	4
June	50	0	0	6	3
July	56	0	0	6	11
August	81	1	5	2	11
September....	78	0	0	4	9
October......	52	1	3	2	6
November	61	0	0	2	6
December	75	0	0	17	7
Total....	749	11	18	83	79

Of these fires, the number wherein the premises were totally destroyed was	29
Very seriously damaged	231
Slightly damaged..	489
	749
Alarms occasioned by chimneys on fire	83
False alarms..	79
Making the total number of calls during the year	911
The number of instances in which an insurance was known to have been effected on the building and contents was	276
On the building only	124
On the contents only..	107
No insurance on either	242
	749

These particulars of insurance refer exclusively to the premises in which the fires broke out, no notice being here taken of damages to adjoining properties.

The number of false alarms is slightly above the average of the preceding ten years, while the alarms from chimneys on fire are considerably below that average, and are nearly the same as in 1842.

The *total losses* exhibit an increase of two over the decennial average; it is, however, a decrease in proportion to the total number of fires reported.

The greater number of last year's fires were generally of a very unimportant character; there were, however, exceptions, and the following are worthy of notice:—

January 16, 6¾ P.M. A fire broke out in the well-known floorcloth manufactory of Mr. Rolls, near the Canal-bridge, in the Old Kent-road, and spread to the adjoining factory, belonging to Mr. Goulston, long before any effort could be made to arrest the progress of the flames. A dense fog prevailed at the time. The West of England and several of the Brigade engines were, notwithstanding, very soon on the spot; but it was some time before they got into action from scarcity of water. By means of a large quantity of hose joined up, the canal adjacent was made available, and one engine was worked by the scanty supply afforded by a solitary plug, belonging to the Vauxhall Company. Upwards of half-an-hour elapsed before even this supply was obtained, and one hour and a half was consumed before the Lambeth Company's water reached the pipes in this locality. The heat of the burning buildings was tremendous, and the firemen found full occupation in saving those towards which the flames were directed. Both the manufactories were completely destroyed, as well as two dwelling-houses adjoining.

January 25, 4½ A.M. Messrs. Garton and Co.'s turpentine distillery, Globe-stairs, Rotherhithe. These premises were of great magnitude, and the distillery, a large building, occupied the centre. The still-house and its contents were destroyed, but the rest of the buildings were happily saved.

January 28, 5½ A.M. 45, Upper Grosvenor-street, the temporary residence of Sir G. Larpent, who, with his family, had just left town to proceed to the West of England. A candle having by some means been brought in contact with one of the bed-curtains, the apartment was in flames before the accident was discovered. On an alarm being given, a number of engines were quickly on the spot, and the most energetic endeavours made to save the mansion. The flames had gained such an ascendancy, however, that it was with great difficulty their progress was arrested. After the heat of the fire had been in some degree checked, Goddard and Maclean (of the fire brigade) entered the first-floor window to follow up the advantage they had gained, when the floor suddenly gave way, and precipitated them, together with a mass of ruins, into the floor beneath. They were extricated as quickly as possible. Goddard, whose bravery has before obtained honourable mention in these Reports, escaped with a few severe bruises and burns; but Maclean was so severely injured, that he expired soon afterwards in the hospital. The greater portion of the building and its contents fell a prey to the flames.

April 5, 1½ A.M. Royal Hospital Brewery, Greenwich. This fine brick building was erected about twelve years since on the most improved principle, and fitted up with a steam-engine, and other valuable machinery, by Messrs. Braithwaite and Co. At the time stated a light was perceived in the second floor, and an alarm raised. The hospital engines were soon got out; but a scarcity of water rendered them almost useless; at length, water being obtained, they were brought to bear upon the flames; one of them, a new one, built by Mr. Merryweather, rendered material service. The force was eventually augmented by the arrival of two of the Brigade engines, and the West of England, from town, by the combined powers of which the fire was extinguished. The fire is supposed to have been occasioned from the flues having been overheated, and ignited some combustible matter in contact therewith. Nearly the whole of the valuable plant and stock was destroyed.

April 9, 12 P.M. As police-constable J. Millist (M 222) was passing the house of Mr. Tarrett, sign of the Rose and Crown, Salisbury-lane, Bermondsey, he observed such an unusual light in the attic, that he went to the door, and stated that he thought the garret was on fire. Mr. Tarrett went up stairs with the policeman; and on opening the front attic door, they found the mattress, a chair, and some linen in flames, and Mr. Tarrett's niece fast asleep in the bed, so utterly unconscious of her imminent peril, that on Millist rushing into the room, and bringing her out in his arms, she implored her uncle *not to let the policeman take her, for she had done nothing wrong!* This circumstance is highly creditable to the watchfulness and bravery of Mellist (who was formerly attached to the Fire Brigade); a few minutes later, and his efforts would have proved unavailing. The female

being placed in safety, the fire was soon extinguished.

May 1, 5¼ P.M. A lamentable explosion of fireworks occurred at the firework manufactory of Mr. Fenwick, in Regent-street, Lambeth. Mr. John Fenwick, son of the proprietor, was charging a fusee, which unaccountably ignited in his hand. He immediately threw it on the floor, and endeavoured to escape; but before he could accomplish this intention, the other combustibles in the place ignited, and the workshop was blown into the air. A workman named Field, and Mr. Fenwick, jun., died from the injuries they received. Mr. Fenwick's premises were in the immediate vicinity of those formerly occupied by Mr. D'Ernst, who, it will be remembered, with three others, lost his life by a similar calamity about twelve months before. These premises, now in possession of Mr. Darby, were the scene of another alarming explosion on the 20th of this month (May), but without being attended with any personal injury.

June 17, 10 P.M. Mr. Roll's floorcloth manufactory, Old Kent-road. When these premises suffered so severely from fire in January last, some out-buildings and the drying house were, by dint of great exertion on the part of the firemen, preserved. Upon this occasion the drying house and its contents were burned to the ground before any assistance could reach the spot.

June 20, 11¾ P.M. 17, Calthorpe-street, Grays-inn-road, the residence of Mr. Cole, was discovered to be on fire. On the first alarm Mr. Cole ran down stairs into the street, when he found that his wife and daughter, who he supposed had followed him, were at the second-floor window. He returned to their assistance, but found it impossible to descend again, and they remained at the window a short time, when one of Wivell's fire-escapes, belonging to the inhabitants of Brunswick-square, was happily brought to the spot, and the inmates rescued. The prompt attendance and active exertions of the firemen soon extinguished the fire, but not until the greater portion of the building and its contents had been destroyed.

July 10, 10¼ P.M. A fire broke out in the marine stores of Mr. Markes, Esther-pl e, Greenwich. The fire first commenced in a storehouse filled with rags, pitch, tar, a other highly combustible matters. The p sh, dockyard, and college engines were p mptly on the spot, and were followed in a ncredibly short space of time by the engi s of the Brigade, West of England, and C nty fire-offices, from town. For upwards o n hour a scarcity of water greatly imp ed the exertions of the firemen. A good s ply was afterwards obtained, and soon poured with good effect upon the burning mass. A large warehouse, storehouse, and stable were destroyed, and the surrounding property damaged to a great extent. The origin of the fire remains enveloped in mystery, but it is supposed to have arisen from spontaneous combustion.

July 11, 10, A.M. A most alarming conflagration burst forth from the extensive candle manufactory of Messrs. Palmer and Co., Great Sutton-street, Clerkenwell. The fire began in the palm-oil warehouse, and from the combustible nature of the stock, and the premises being for the most part built of timber, the flames spread with astonishing rapidity. Fortunately the air was still, water plentiful, and a number of engines at work in a few minutes, and in little more than half-an-hour the fire was subdued, but not until the palm-oil house and melting house were a heap of ruins, and a number of adjacent buildings more or less injured.

August 5, 6¾ A.M. An alarming fire broke out in the tool handle manufactory of Messrs. Moseley, in New-street, Covent Garden. These premises are in the centre of a mass of buildings fronting to New-street and Rose-street, and were at the time filled with a large stock of timber, in various shapes and sizes. The firemen were very quickly on the spot; but from the smallness of the mains in this locality, a proper supply of water could not be obtained. Notwithstanding these difficulties, the firemen in little more than an hour had the fire completely in check.

At 11 o'clock the same night, the reddened sky indicated the raging of an extensive conflagration eastward, which proved to be at the private dwelling-house of Mr. Mills, Fore-street, Limehouse. Thither proceeded the firemen with all possible speed, and bravely exerted themselves to arrest the progress of the flames. After a while, the usual success attained their well-directed exertions, when the glare of another conflagration drew off a portion of their forces at 1 o'clock on Sunday morning, to the scum boiling-house of Mr. Bird, Green Bank, Wapping. The West of England engine was the first to reach the spot, and was quickly followed by those of the Brigade, which became entirely engaged with this new calamity. Notwithstanding the efforts that were made, the building, and contents of the scum-house, were destroyed.

While in the very heat of this contest, the western portion of the heavens became illumined in its turn by a fire which broke out at the residence of Mr. Villiers, Great George-street, Westminster. The West of England engine was again galloped off, an

became actively engaged upon the flames. The Brigade and County engines soon joined in the contest, which, like its immediate predecessor, became a sharp one. Mr. Villiers' premises and their valuable contents were all but destroyed, and a number of adjacent buildings seriously damaged.

It is somewhat singular that no satisfactory explanation could be obtained as to the causes of these four fires.

August 19, 2 A.M. This, the most destructive fire of the year, broke out in the premises of Mr. Ward, oil and colour merchant, in Tooley-street. Before the fire was discovered, it had gained a most alarming ascendancy, and no sooner was the alarm given, than the premises of Mr. Ward, and those of Messrs. Schovell, well known as Topping's Wharf, were enveloped in flames. A number of the Brigade engines were very quickly on the spot, followed by the West of England and County, but for a long time the scarcity of water sadly crippled their operations. The flames, meantime, kept extending their ravages, involving the premises of Messrs. Cox and Co., lead merchants, and an uninhabited house (No. 5) belonging to the Tallow Chandler's Company, in one common ruin. A very vivid recollection of the former burning of Fenning's Wharf, and a knowledge of the immense amount of property at this time deposited therein, caused the firemen to make great, and, as it ultimately proved, successful efforts for the preservation of that restored building. The vast importance of stopping the progress of the fire in that direction, caused the church of St. Olaves, towards which the flames were fast progressing, to be somewhat neglected. Whether too much reliance was placed on the substantial character of the stone walls, or on the sacred character of the edifice, does not appear; certain it is, that the cry of "the church in danger!" excited but little attention until it was too late. Mr. Connorton, with the West of England engine, made an effort to counteract the effects of the heat that was threatening the tower but the height of the building, and the gale that was blowing at that point, rendered the attempt nugatory. The belfry was examined, with a view to leading a hose into it, but the time for that arrangement was past. The substantial character of the building would, indeed, have saved it, but the belfry window presented a vulnerable point; here the flames found an easy and unopposed entrance, from whence they rapidly spread over the roof, and other parts of the edifice. By this time the supply of water had become abundant, and all the land engines were in full operation, as well as the two powerful floating engines. The fury of the flames to the westward being somewhat checked, all the available force was now turned towards the church, and here the fire was ultimately stopped; but not until the roof had been burned off, the belfry, bells, organ, galleries, pulpit, &c., destroyed.

A parishioner of St. Olaves, in a communication to the editor of the *Times*, (which was not published,) complained of the supineness of the parish authorities. "Within the church door," he observes, "there stood a good-sized fire-engine, properly appointed, and in good working order, which should have been brought out at the commencement of the fire. It was only drawn out for its own preservation, after the church had been for some time on fire. I have been told by a party exceedingly well-informed on the subject, that had the hose of our own parish engine been taken up into the belfry as soon as a supply of water could have been obtained, the church might have been saved! For what purpose are we continually burdened with the expenses of repairing and equipping a fire-engine, paying for an engine-keeper, &c., neither of whose services are available for protecting the property of the parishioners, or of the church itself?" Some burning embers from this fire being carried into the premises of Mr. Jones, grocer, 268, High-street, corner of York-street, Borough, ignited the stock in the shop, but an engine being instantly despatched there, the fire was soon stopped, and the engine returned to its employment in Tooley-street.

Soon after 4 o'clock, before the firemen had got the fire in Tooley-street under control, another conflagration westward was seen from London Bridge. This fire proved to be on the premises of Mr. Newbery, practical chemist, and dealer in fireworks, 160, Fetter-lane. The policeman on duty in Fetter-lane stated, that soon after 4 o'clock he was alarmed by a loud explosion, almost instantly followed by a second, which blew Mr. Newbery's shop-front across the street. Mr. Newbery precipitated himself from the second-floor window, and a Mr. Rose soon followed him from the third floor; both were taken to St. Bartholomew's Hospital, but Mr. Newbery was found to be dead, and Mr. Rose died in half-an-hour afterwards. As soon as the fire was got under, and the ruins could be entered, the bodies of Mrs. Rose and her two sisters were found, presenting a mass of charred bones. The back part of the house had been completely blown down by the violence of the explosion, and the remaining portion ignited. Seven of the Brigade engines, and the County, from the fire in Tooley-street, were promptly on the spot, and the fire was soon got under without

causing the danger which at first threatened the neighbourhood. A set of fire-escape ladders (of which there are twelve stations in St. Andrew's Parish) were brought to the spot by the police, but the instantaneous character of the calamity precluded the possibility of timely assistance.

August 24, 9½ P.M. A fire broke out in the extensive premises of Mr. Mandeville, hemp and cane merchant, Kent-street, Borough. From the combustible character of the warehouses, filled with canes, the flames for a time raged with a fury that threatened destruction to the neighbourhood. The firemen, however, were promptly in attendance, and soon obtained water from the Southwark mains, but in so small a quantity as to be wholly inadequate. The Vauxhall Company have mains in this locality, but it was upwards of an hour and a half before any water was obtained from them. By the most skilful application of the small quantities of water that could be procured, the firemen succeeded in cutting off the flames, and saving two-thirds of Mr. Mandeville's premises.

Sunday, September 17th, six fires called for an unusual amount of exertion on the part of the firemen, three of the number being of a serious character. The first occurred at ½ A.M., on the premises of Mr. Burchfield, rope-maker, Penny-fields, Poplar, and caused the destruction of the tar, yarn, and oakum houses. The next, at 6½ P.M., was at the City saw-mills, belonging to Mr. Kelland, in Wentworth-street, Whitechapel. The flue of the steam-furnace being overheated, set fire to the roof of the engine-house, which was destroyed, and a large stock of timber seriously damaged. In an hour afterwards a fire broke out in the toy warehouse of Mr. Wood, 15, Whitechapel-road, which, notwithstanding the firemen and engines were so close at hand, and so promptly in operation, was burned to the ground.

October 11, 2 A.M. Smoke was observed issuing from the premises of Mr. Labram, 36, St. Martin's-court, Leicester-square, and an alarm of fire raised. The Brigade engines from the Chandos-street station were instantly brought up and set to work, but by the time they arrived the building was in flames from top to bottom. From the extreme narrowness of the passage, and the close proximity of the houses on all sides, an awful destruction of property seemed inevitable. As the engines followed each other in rapid succession, the fire was surrounded, and, by almost superhuman efforts, was extinguished in an incredibly short space of time, and the damage done for the most part confined to Mr. Labram's premises, which were entirely destroyed. As soon as the ruins could be entered, the firemen found the lifeless bodies of Mrs. Pollock (a lodger) and her two infant sons, who had perished in their apartment. This calamity is mainly attributable to the folly of the persons in the house, who smelt fire, and questioned the cause, as early as 10 o'clock on the night previous. Had an application at that time been made at the Brigade station, only a few yards distant, a fireman would have attended, and ascertained the latent cause of the mischief, or have kept such a watch as would have prevented any serious consequences; and this *without any expense* to the inmates. The services of the firemen are, at all times, and under all circumstances, *perfectly gratuitous*, and yet there is often a most unaccountable reluctance to accept them.

November 12, 8½ P.M., a most destructive fire broke out in the premises of Messrs. Ogleby, oil merchants, and patent candle manufacturers, Paradise-street, Lambeth. A dense fog prevailed at the time, and prevented the fire being visible, as it would otherwise have been, at great distances. The flames first appeared in the oil warehouse, in which they raged most furiously, and soon extended to the cooperage, pressing-room, and stables, which were wholly consumed. From these the fire spread to the melting-house, candle factory, and also to the numerous houses adjacent, in Paradise-street and Norfolk-row. After upwards of three hours uninterrupted exertions, the firemen got the upper hand of the fire, and soon afterwards succeeded in completely extinguishing it.

November 20, 3½ A.M. The extensive premises of Mr. Robinson, (late Bramah's) Eaton-lane, Pimlico, were discovered to be on fire. The flames commenced their career in the engineering shops, from whence they rapidly spread to the pattern and model shops. A number of engines were promptly on the spot, but it was some time before enough water could be obtained to make them serviceable, and the fire raged almost uncontrolled, with a light which was visible for many miles round. A sufficiency of water being afterwards procured, the fire was mastered. The premises were supposed to have been wilfully fired by a maniac.

The last serious fire of the year occurred December 21, at 7½ P.M., in St. John-street-road, on the premises of Mr. Turner, floorcloth manufacturer; it originated in the overheating of a drying stove, and, before any assistance could be afforded, destroyed the whole of the manufactory, which was built entirely of timber, and filled with the most inflammable materials.

The following table shows the occupancy of the various premises in which

last year's fires originated, discriminating, as heretofore, between those fires which commenced in that portion of the building devoted to the business of the occupant, from fires which happened in, and damaged the dwelling apartments only:—

Apothecaries	1
Asphalt works	1
Bacon dryers	2
Bagnios	8
Bakers	10
Ditto biscuit	1
Ditto muffin	1
Barge and boat builders	2
Bleachers	1
Booksellers, binders and stationers	11
Brewers	3
Brokers and clothes salesmen	2
Builders	6
Cabinet makers	10
Carpenters and workers in wood	23
Chandlers	3
Charcoal and coke dealers	5
Cheesemongers	4
Chemists	1
Churches	1
Coachmakers	3
Coal merchants	2
Cocoa-nut fibre manufacturer	1
Coffee and chop houses	15
Coffee roasters	2
Colour makers	3
Confectioners and pastrycooks	6
Cornchandlers	2
Coopers	4
Cotton winders	1
Cotton wick makers	1
Cotton wool, workers in	1
Distillers, illicit	1
Ditto, turpentine	1
Drapers, linen and woollen	20
Druggists, wholesale	1
Dyers	3
Eating houses	5
Farms	9
Fellmongers	3
Firework makers	5
Floorcloth manufacturers	5
Foundries	4
Gas works	4
Glue makers	1
Grocers	8
Hat manufacturers	9
Hemp and flax dressers	1
Horsehair merchants	1
Hotels and club houses	4
Japanners	2
Laundries	2
Leather (patent) manufacturers	1
Lodgings	59
Lucifer match makers	7
Lunatic asylums	1
Manchester warehouse	1
Marine stores	4
Mast and block makers	2
Musical instrument makers	1
Oil and colourmen	12
Private dwellings	289
Painted baize makers	1
Painters, plumbers and glaziers	1
Pawnbrokers	2
Pork butchers	1
Potteries	1
Printers and engravers	8
Public buildings	5
Railways	1
Ropemakers	3
Sale shops and offices	23
Saw mills (steam)	5
Scum boilers	1
Ships	2
Ships (steam)	1
Ship builders	2
Silk winders	1
Stables	6
Starch makers	1
Sugar refiners	1
Tallow chandlers and soap boilers	6
Tailors	3
Tarpawling manufacturers	1
Theatres	2
Tinmen, braziers and smiths	6
Tabacconists	2
Toy warehouses	1
Type founders	1
Under repair, and building	8
Unoccupied	7
Upholsterers	2
Varnish makers	1
Victuallers licensed	30
Wadding makers	2
Watch-glass makers	1
Wharfingers	1
Wine and spirit merchants	4
Wood merchants	2
	749

The number of fires on each day of the week was as follows:—

Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.
119	100	113	99	110	111	97

The hourly distribution throughout the day and night has been as follows:—

	First Hour.	Second Hour.	Third Hour.	Fourth Hour.	Fifth Hour.	Sixth Hour.	Seventh Hour.	Eighth Hour.	Ninth Hour.	Tenth Hour.	Eleventh Hour.	Twelfth Hour.
A.M.	53	35	34	25	27	18	16	9	7	17	23	15
P.M.	22	18	21	19	26	35	52	47	66	74	43	46

The causes of fire, so far as the most diligent enquiry could ascertain were as follow:—

Accidents, various	19
Apparel ignited on person	5
Bleaching brushes	1
Candles, various accidents with	49
Carelessness, palpable instances of	21
Cats	2
Children playing with candles	4
——— with fire	11
——— with lucifers	5
Cinders put away hot	3
Coppers set on floors, &c.	4
Curtains, window, ignited	69
——— bed ditto	48
Drunkenness	6
Fires kindled on hearths and other improper places	7
—— on roofs	2
—— raking out	3
Fire sparks	17
Fireworks, making of	3
Ditto, letting off	2
Flues defective	16
Ditto in next house	13
Ditto, foul, ignited	53
Ditto, overheated	16
Ditto, stopped up	7
Friction of machinery	1
Fumigation	1
Furnaces	17
Gas making	2
Ditto escape of, from defective fittings	16
——— street mains	2
Ditto lighting of	10
Ditto fittings, repairing of	6
Ditto left burning too high	4
Gunpowder	1
Hearths, defective	2
Kilns overheated	2
Lamps, naphtha	2
ne, slacking of	2
en, airing	33
ifer matches, making	6
———, using	8
ens overheated	7
—— badly set	3
ch and tar, boiling of	7
ker left in fire	2
ding in bed	2
vings, loose	31
ntaneous ignition of coals	1
Spontaneous ignition of cotton	1
——— charcoal	5
——— dung	1
——— gunny bags	1
——— hemp	1
——— India rubber matting	1
——— hay	5
——— lamp black	4
——— rags, damp	1
——— greasy	2
Smoking tobacco	14
——— in bed	1
Stills, illicit	1
Stoves, defective	14
———, drying	15
———, ironing	1
———, overheated	10
———, pipe	14
Suspicious	16
Varnish making	6
Wilful	21
	689
Undiscovered	60
	749

The causes of fire have of late years excited a good deal of attention, and a careful consideration of the foregoing table cannot fail to prove useful. The recorded causes of fire are much of the usual character, some of them of a singular nature, such as few persons would have anticipated. The following well-authenticated occurrence is worthy of being placed on permanent record; it is extracted from the *Shropshire Journal* of September last:—

"Many have been the doubts and suspicions as to the origin of fires, and great excitement has occasionally prevailed, where the cause of such calamity has remained in mystery. Very recently the total or partial demolition of a noble manorial pile in Montgomeryshire might have happened by fire, and the origin been involved in perfect mystery, had it not providentially happened that

one of the establishment discovered smoke in time to prevent the extension of mischief. During one of the recent hot days, the Countess of Powis's attendant, whilst in her bedroom at Powis Castle, about 10 o'clock in the morning, was somewhat alarmed at a smell of fire, and immediately instituted a rigorous search. Fireplace, cupboards, drawers, &c., were subjected to scrutiny, when it was discovered that a toilet cover on the dressing-table had just taken fire. The *femme de chambre*, conscious that no one had been there during the morning with fire, was exceedingly puzzled. Having extinguished the ignited article, she resumed her occupation, but was again astonished to smell fire. On approaching the table, she found that the sun's rays, concentrated on a globular water-bottle, which formed a lens, had burnt the table-cover in two places through its several folds. Astonished and incredible, she called some of the servants, who witnessed a third ignition by the same means. Had it occurred an hour later, the fire would not probably have been discovered until it had attained an ascendancy; and thus would a fire of an alarming nature have been created, the cause being wrapped in mystery and suspicion."

I have before alluded to the dangers arising from discarded lucifers; there is little doubt that many of the fires, the origin of which has never been discovered, are attributable to this cause. A very singular instance of fire from discarded lucifers, occurred very recently in the country, where a match having been bound up in a sheaf of corn ignited under the flail of the thresher.

Much has lately been said on the subject of chimney-sweeping. The advocates of the abominable climbing-boy system assert that the number of accidents from fires in chimneys has greatly increased since the introduction of mechanical sweeping. There is not, however, the slightest ground for any such statement. The only data for forming an accurate estimate on this head would be a return from all the parishes of the number of rewards paid to engine-keepers for attending chimneys on fire for some years past. This, I apprehend, is scarcely attainable, certainly not without more trouble than it is worth. The fact is just this, that when fires in chimneys do occur, it is not because the mechanical mode of sweeping is not effectual, but simply because the chimney has not been swept at all! The periods of sweeping essential to the prevention of accident vary so greatly, that no general rule can be given; thus, for instance, of two chimneys in equal use, the one having a quick draught, the other a sluggish one, the latter will require sweeping at least twice as often as the former. The chimneys of parlours only occasionally used may very well go a twelvemonth between the sweepings, while many a kitchen chimney in daily use becomes unsafe if left unswept a single month.

There is one point connected with this subject, however, upon which it is necessary to say a few cautionary words; it is this, when chimneys take fire, it is principally in consequence of the foulness of its throat, where large quantities of soot are collected within reach of the ordinary flames of the grate. If the throat of the chimney is kept clean by sweeping it with a hand-broom once a week, or oftener, the chimney will not be very likely to take fire, even if foul above. If the throat be kept clean, the impaired action of the chimney, visible in the well-known effect of *smoking*, will warn the housekeeper of the necessity for sweeping long before an accident is likely to occur. So that a chimney be swept *at proper intervals*, it matters not whether it be swept as the boys *used* to do it, or as the machines now *can* do it.

Competition has been rife among mechanical chimney-sweepers during the past two years; but it is an act of justice to say, that Glass's simple and ingenious machine still maintains its superiority, and stands unrivalled for this purpose. There are a few of Smart's machines still in existence, and a large number of Glass's at work: it is the fault of the housekeeper where such are employed, as there are plenty of men who use efficient instruments in all parts of the metropolis.

The subject of fire-prevention is beginning to receive some small share of public attention, and many precautionary measures are now introduced into most of our principal buildings; indeed, many of the public and private buildings recently erected have been built in a fire-proof manner throughout. Numerous suggestions for extinguishing fires have been put forth during the last year or two. One very singular proposition, which emanated from a foreigner, strongly reminds me of the directions often given

to juveniles for catching sparrows by "putting a little salt on their tails!" This gentleman visited this, and several continental cities, to promulgate his *decidedly original* plan, which consisted in dusting a certain powder (into the composition of which sulphur largely entered) from a gigantic pepper-box over the burning mass, when the fire taking umbrage thereat, would indignantly "go out." The gentleman and his scheme were most politely entertained by the Government authorities here, who prepared to test his plan upon a most conclusive scale. A large pile of spars, old rope, tar barrels, and such like matters as usually occur in dockyard stores, was built up in the yard at Deptford. This it was proposed to ignite, and leave our hero of the powder-puff to put it out—if he could. The ugliness of the pile, or the want of a pepper-box with a sufficiently long handle, however, scared away the principal actor, long before the performance should have begun.

Two or three other parties have resuscitated long-exploded contrivances for deluging the roof and several floors of a building with water instantaneously, in the event of fire, without any regard to where or what the fire may be. One gentleman (an engineer of long standing) has patented the very excellent, though somewhat antiquated method, of a descending main from an elevated reservoir, with screwed nozzles on each floor, to which a leather hose and branch pipe may be affixed. This is a plan which I have for some years advocated in your pages, and one that has been long adopted in many public and private buildings—the British Museum being a notable instance.

Some experiments have recently been exhibited (principally for the purpose of puffing a particular water company) by which it was intended to demonstrate that fire-engines are by no means necessary for extinguishing fires. The experiments were conducted with great apparent fairness; but, by some process of legerdemain, a ⅞ths jet, rising only *fifty* feet high, was said to deliver *one hundred* gallons of water per minute. The source plug was stated to deliver water enough, to supply three fire-engines working ⅞th jets, and delivering about sixty gallons of water each per minute! The lamentable deficiencies of the supply of water at fires by this Company* have long been notorious, and it will be well if they can make any such arrangements for the future as will prevent a recurrence of this evil. Let the Company's engineer ensure a timely and sufficient supply of water, and he shall be commended, even though the engines should be obliged to be employed to pump it on to the burning premises. Novelty in the scheme there is none; I have seen the same tried years ago in Manchester, Birmingham, and London. In the metropolis this mode of working direct from the plug, has been resorted to for extinguishing fires,† and for cooling ruins, for more than half a century, whenever the pressure on the mains was sufficient for the purpose. On reference to your early volumes, it will be seen that I recommended every householder near whose premises a fire-cock was situated, to provide a length of hose and a branch pipe, which would give him a ready means of extinguishing fire in the lower part of his premises. Shops, cellars, and the like, might, in many of the town districts, be effectually protected in this manner. It will not do, however, to take the branch up into a second floor, (as I recently saw done,) and expect to obtain a jet at that elevation. For this reason the plan has a limit to its usefulness, and indeed is only to be resorted to previous to the arrival of an engine.

When the fire occurred at Mr. Robinson's in November last, some person most imprudently took the leather hose away from a fire-engine fixed over a well on the premises, and attached it to the Chelsea main; the water not being turned on, this expedient failed; whereas, had the engine been got to work, it is very probable that the fire might have been much sooner checked. All these matters require more judgment, and greater practical skill, however, than can be expected from persons unaccustomed to the business.

Incendiary fires have been of frequent occurrence this winter throughout the agricultural districts, and have led to a most lamentable destruction of property. Many of the country villages are wholly unpro-

* The Southwark; vide the present and former Report.

† This plan was most successfully resorted to in Hamburgh at the late conflagration, Mr. Smith's water-works there giving a jet seventy feet high!

vided with fire-engines, while the greater portion of those in the adjacent towns are so old and dilapidated as to be wholly useless. The greatest evil at country fires, however, is the want of water, which has, on several recent occasions, rendered fire-engines of the best description impotent. When the facility with which ponds may be formed in many situations, and the great advantages they afford to farms are considered, it is singular that so little pains is taken to provide them. Many towns have lately been furnished with new and improved fire-engines, and fire-brigades of a voluntary character have been formed with the best results.

During the past year, all the fire-engines of the London Fire Establishment have been fitted with increased length of handles, which turn up fore and aft. The barrels being 7 inches in diameter, and being now capable of being manned with from 28 to 32 hands, they are capable of doing every thing that can be desired, either in the quantity of water delivered, or the height to which it can be thrown.

The firemen have continued to conduct themselves very much to the satisfaction of their employers, as well as greatly to the benefit of the public. A more striking instance of this could hardly be cited than the fact, that during the past year only two men have quitted the service.

In a work which I have already quoted it is remarked, that "The general economy of the establishment, and the fearlessness of the Brigade men, have won a large measure of praise from nearly all classes in the metropolis. If self-interest were the chief motive which led the insurance companies to the establishment of a system likely to reduce their own losses, there is anything but selfishness in the risks which the men encounter in saving lives and property—for the poor as well as the rich—the uninsured, as well as the insured."

This is no more than justice to a most zealous and courageous body of men; but it is necessary to state, that to the Brigade men alone the remark should not be confined. The firemen of the West of England Office fully sustain the high character which I have awarded them in former reports. Ever prompt in their attendance, they are always ready to make every effort that experience can suggest, and to share in every danger. Under the direction of their skilful foreman, Mr. Connorton, they have, on many occasions, rendered most essential service, and contributed in no small degree to the general success. The County firemen, under Mr. Carter, have also been in more frequent attendance at fires, and several parish engineers in the metropolis have acquitted themselves most respectably on several occasions.

The Brigade continue to profit by the superintendence of Mr. Braidwood, and it is to be hoped that so able a general, and so exemplary a corps, may long continue to work together with that deserved success, which has hitherto crowned their efforts.

26, Alfred-street, Islington,
Feb. 10, 1844.

THE INVENTION OF ELECTROGRAPHY—MR. SPENCER IN REPLY TO MR. DIRCKS.

Sir,—In a note appended to my last communication, you express regret that I should have let anything interfere with an immediate reply to Mr. Dircks. Well-meant as that advice was towards myself, it was contrary to that of my friends who read the attack, and certainly to my own opinion, until, at least, I was at full leisure to reply. Nor did I deem his statements, with regard to myself, of such high importance as to require any undue haste. I think, however, you will now admit I was not wrong in pursuing this line of conduct. By referring to Mr. Dircks's last contribution to the Magazine, it clearly appears that he had not made the whole of the charges one would have thought he was bound to do, at the time he published his first paper.

Whenever Mr. Dircks says his case is complete—or, in other words, when he confesses to have brought before the public all the facts or opinions he may be in possession of, with reference to myself, and the discovery of electrography—I shall then feel bound to think seriously of replying to his statements. At present, however, I have neither time nor inclination to keep up a mere war of words with him, either through the medium of your own columns, or those of a newspaper. Take the following as an example of what this sort of thing would lead to:—Let us suppose that which is not very wide of the truth,—that Mr.

Dircks makes statements which I know to be unfounded in fact. Say then, I reply by a denial. Mr. Dircks, however, in your next, either reasserts them, or presses something fresh, taking no notice whatever of the denial. Why, Sir, a fertile imagination, combined with a dash of mendacity on the part of the accuser, might even tire the patience of the accused, to say nothing of your readers.

But why go to hypotheses? Here are two cases taken from your last week's Number, which are neither more nor less than simple falsehoods.

Mr. Dircks says, I entertained the idea that ships' bottoms might be coppered by the electrographic process, and that I sent a model vessel, so covered, to the Admiralty. The avowed intention of this is, to convey that I must have possessed but a very imperfect knowledge of the subject when I was capable of entertaining an idea so absurd. So, indeed, I confess I would. It does so happen, however, that my opinions are on record, where I ridiculed such an idea when proposed to me. In addition to which, *I did not send a model, so covered, to the Admiralty.* I have long since put amateur ship-builders in the way of covering the bottoms of their toy vessels with copper; but at a meeting of the Polytechnic Society I devoted part of an evening to show the utter absurdity of such schemes on a large scale. So much for case the first. Now for the second.

Mr. Dircks states that my right with respect to a patent in connexion with electrography is at present matter of legal contest against me. To this I think it will be unnecessary to say more than, if such indeed be the case, I am in blessed ignorance of the fact—a state of things, you will admit, by no means usual with a defendant under such circumstances.

I could quote a few more of a similar nature from last week's Number; but suppose Mr. Dircks chose to repeat that e above—trivial as they are—are true, which is by no means improbable,)—m I bound either to let judgment go by efault, or to apply to the Admiralty for ritten authority to prove the negative on e one hand, or to make inquiry in the oper law-courts to ascertain whether ere is any thing pending against me on e other? I put it thus to show its abrdity.

Unless, therefore, Mr. Dircks makes a fixed statement, which he will bind himself to keep to—friend Dircks being what we call in Lancashire "a slippery customer"—and inform us when it is complete, I do conceive I am not bound to answer until then; more especially when he informs us he intends to publish his ideas on the subject in another form—in all probability in the shape of a pamphlet, which may be transmitted through the post-office; nor does he put this contingency as to whether he is refuted in his statements or not. I should therefore, under the circumstances, be noways surprised, even should the whole of these charges be successfully rebutted, to find Mr. Dircks get HIS "*contributions towards a history*," as he facetiously, no doubt, terms them—printed almost *as they stand*, and sent gratis—of course he could not hope for a sale—to all quarters where he thought my reply would not be met with. To a certain extent he is now doing so, with those Numbers of your Magazine that contain his own papers. As a sort of wholesome check to our friend's mania for a one-sided diffusion of knowledge, I make the following proposal; and if he is the honest friend of truth he takes such pains to tell us he is, he can have no possible objection to it. First, then, that he shall make out the whole of his case through the medium of your pages, or say if he has already done so. After which I shall make a definite reply in the same periodical. The whole case thus put shall be submitted to a committee of gentlemen of acknowledged competence to decide how far either party has sustained his case. Second, should Mr. Dircks wish to reprint his contributions on this subject, that he shall agree to append to them the decision of the committee, be it what it may.

I am, Sir,

Yours very respectfully,

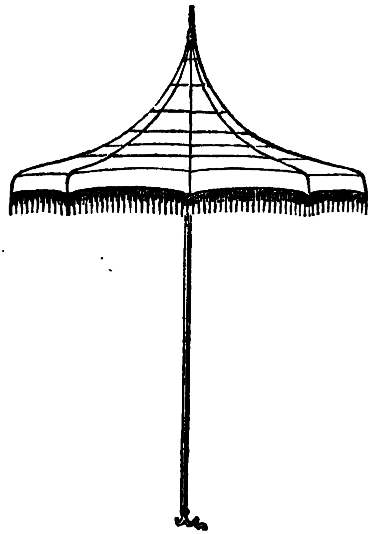
THOMAS SPENCER.

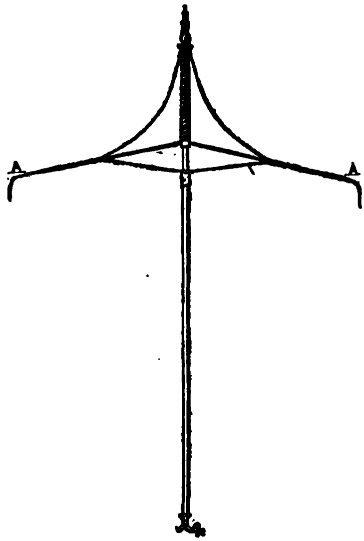
Liverpool, Feb. 27, 1844.

THE WINDSOR PARASOL — ALEXANDER WILSON, OF MILK-STREET, CHEAPSIDE, PROPRIETOR.

[Registered under the Act for the Protection of Articles of Utility.]

The "Windsor Parasol" is an improvement on another, registered a season or two ago by the same manufacturer, and





well known, we dare say, to many of our readers by the name of the "Pekin parasol." It is one of a class of articles which exemplify very strikingly the beneficial operation of the recent Act for the protection of new designs. The amount of inventive ingenuity displayed in it is not great, consisting simply in bending down by heat the ends A A of the whalebone ribs, whereby a greater degree of shade is obtained, and the article rendered much more elegant in its general form and configuration. And though, it is perhaps the handsomest thing of the sort which has yet appeared, it is very certainly destined to be supplanted ere long (in the same way as it is about supplanting its Chinese precursor) by some *newer* novelty—so essential is novelty, above all things, to the goddess of fashion—so insatiable her demands—so absolute her decrees. But novelty is a real want of society as it is, which must be supplied in some way or other; the supplying of it, no matter how slight may be the differences or variations on which it turns, gives employment and bread to thousands; and if we cannot manufacture novelty enough of our own to meet the home demand, we must go abroad to make up the deficiency. Now the best stimulant to native ingenuity is, undoubtedly, protection, and that protection it has never, until the recent acts we speak of, enjoyed in more than a very limited degree. Five years ago such an article as this Windsor parasol could not have been protected at all, except at the *prohibitory* price of letters patent, (for who would patent for fourteen years, a thing which could last but for a season or two?) and were the state of things now as it was then, it is almost certain that we should have had no such home invention as this to notice in our pages. We should, in all probability, have left the trouble of invention, as of old, to our French neighbours, and contented ourselves with such profits as we could glean from the *retailing* of their inventions. But as it is, the invention and the manufacture are alike of home production; and trivial though the design may be which has called forth these remarks, it is one which, besides amply rewarding the proprietor of it, will set hundreds of people to work, who would otherwise have been idle, and, but too probably, a prey to want and misery.

HOT WATER CIRCULATOR—SUITABLE FOR HORTICULTURAL, DOMESTIC, AND OTHER PURPOSES—BENJAMIN FOWLER, OF DORSET-STREET, SALISBURY-SQUARE, IRON-FOUNDER, PROPRIETOR.

[Registered under the Act for the Protection of Articles of Utility.]

Fig. 1.

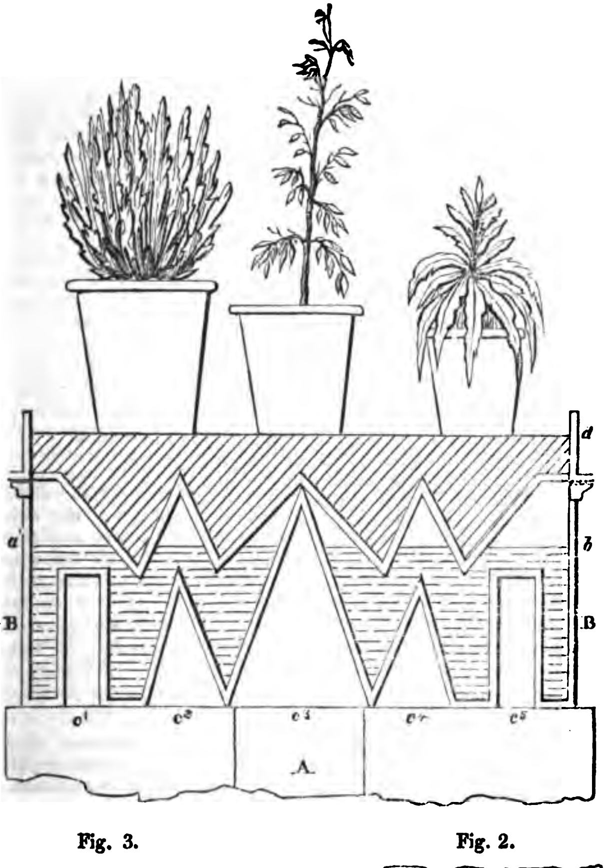
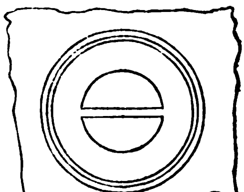


Fig. 3.

Fig. 2.



Mr. Fowler, the inventor and maker of this improved apparatus, is the author of a remarkably clever pamphlet which appeared a few years ago, under the title of "The Philosophical Principles of Heat, as applied to Domestic Purposes: being an enquiry into the merits of various inventions used for warming buildings;" and which contained convincing evidence that the writer united

to a thorough practical acquaintance with his subject far more *philosophy* than falls commonly to the lot of the class of "practical men." In this pamphlet Mr. Fowler condemns—very justly, in our opinion—all the hot air and steam modes of heating, as applied to domestic and gardening purposes, and gives the following cogent reasons for preferring the hot water system :—

"If we follow, in the system of artificial heat, the plan which nature universally adopts, we shall endeavour to obtain an equality of heat by radiation from a large surface at a low temperature; for we have already seen, that heat radiated at a high temperature is positively injurious to animal life, by altering the chemical properties of the air. The plan which appears to obviate all objections most completely, is that of diffusing heat by means of hot water, circulating through large iron pipes; a plan so simple and efficient, that whatever improvements may be made upon it in the course of time, will not, in all probability, in any way affect its principles, but only apply to its universality of adaptation. To describe here the position of the pipes and boiler of this kind of apparatus would be impossible, as their arrangement is nearly as various as the situations to which they are applied; suffice it to say, the pipes and boilers communicate so as to afford a continued stream of hot water from the boiler to the pipes, which give off, by radiation, the heat they thus receive; the water then returns to the boiler by another pipe, to receive a fresh supply of heat, again to part with it as before. The circulation of the water in these pipes is much more rapid than would be imagined; it will travel through a length of two or three hundred feet, in five or six minutes; the cause of this action and rapid flow being nothing more than the different specific gravities of hot and cold water.

"The distinguishing feature of this description of apparatus is, that it has, at some point or other, a free communication with the atmosphere; and as the temperature of the water cannot rise above 212° while this communication continues, the apparatus must always be perfectly free from any accumulation of steam; and there is, therefore no pressure upon it, *except the actual height of the water*, equal to ½ lb. per square inch for every foot of perpendicular height.

"The principal advantages of this invention—leaving out of the question its economy in fuel, though even in this particular its claims to recommendation are not inconsiderable—are, first, the amount of moisture in the air is neither increased nor diminished by its use; secondly, there is no deleterious gas of any kind generated; thirdly, the vital quality of the air is not the least deteriorated, or its chemical properties at all changed,—the radiating surface being of too low a temperature to produce such effects; and, lastly, its perfect safety.

"These are not unimportant advantages when the apparatus is employed to warm dwelling-houses; and where it is used for conservatories, and other horticultural purposes, it possesses peculiar claims to recommendation for its perfect equality of temperature, and for maintaining the heat an infinitely longer time than any other plan. To these likewise may be added another decided advantage,—the great durability of this apparatus in comparison with others; for the large quantity of water which is employed, prevents the boiler ever approaching to a temperature which can injure it; and for horticultural purposes, the exemption from accident of the apparatus employed, is particularly important,—because the stoppage of its efficient working even for a single day, might cause the destruction of every plant in the building. This consequence appears almost inevitable, when any accident occurs to pipes worked on the high pressure plan; for not only would the plants suffer by the non-performance of the apparatus, but such is the expansive force of steam at a high pressure, that the smallest fissure happening in the pipes would instantly be followed by the rending asunder the whole of that part of the apparatus; the escape of steam completely destroying the plants, and not improbably the building also, by its uncontrollable violence."

Mr. Fowler's present improvement in the hot water system consists, firstly, in dispensing with the circular pipes and brick tanks hitherto employed for the purpose, and substituting for them large channels of square, angular, and other forms, which present a much larger degree of heating surface than can be obtained by any other means; and secondly, in making provision, in the case of horticultural hot water circulators, for the occasional application of the vapour arising from the water to promote the growth of the plants.

Fig. 1 is a sectional elevation of this new hot water circulator, as applied to a forcing house. It is made throughout of cast iron. A is the brick basement on which it stands; B B are the sides; C^1 C^2 C^3 C^4 C^5 are five hollow ridges, three of a pyramidal, and two of an oblong form,

which extend from end to end of the apparatus. The centre ridge C^3 rises to the height of the cover, but the four others little more than half-way. The cover D is made of the indented or vandyke form, represented in the figure, or it may be made of any other analogous form, presenting an alternation of projecting and hollow points; the apex of the centre incut or recess resting upon the top of the centre ridge C^3, and the peaks of the under side projecting as far downwards as the tops of the four lower ridges, C^1 C^2 C^4 C^5. All the five ridges are open at the bottom and ends. The spaces between these ridges, and between the outermost of them and the sides B B, as also the spaces immediately above them, between the lower peaks of the top plate, and between the outermost of these peaks, and the sides, as far up as the line *a b*, form the channels or passages through which the water circulates. The centre ridge C^3 separates these passages into two distinct divisions or series, which are closed at each end. The water is conveyed by pipes from the boiler into one of these divisions, after traversing which it flows round through a curved pipe at the farther end into the other division, whence it is returned by pipes into the boiler. The spaces at top, above the line *a b*, are left vacant for the reception of the vapour arising from the hot water, and this vapour, when wanted for promoting the growth of plants, or any other useful purpose, may be let off from either side of the centre ridge by lifting vapour-tight trap-doors of the construction separately represented in the plan and section figs. 2 and 3, and fixed at any convenient places in the top of the plate D, one on each side of the centre. The space between the cover D, and the top *c d* of the apparatus, may be either filled up with sand, as represented in fig. 1, on which potted plants, requiring to be forced, may be placed; or it may be filled with water for the purpose of evaporation; or it may be left open in order to give off heat to the surrounding atmosphere.'

Instead of the ridges being partly of a pyramidal and partly of an oblong form, they may all of them be of either of these forms; or instead of three of them being of the pyramidal, and two of the oblong form, the numbers of each sort may be reversed, or otherwise varied at pleasure.

LOSS OF AN IRON STEAMER.

[We extract the following interesting particular of the loss of the *Elberfeldt* Iron Steamer, from an account of the disaster furnished to the *Times* by a writer who states that he derived his information from Captain Stranach of the General Steam Navigation Company, who commanded the vessel, and Mr. Bush the engineer, who was a passenger. The fate of this vessel may serve to teach certain railers against the Committee of Lloyds for the cautious course that they have pursued in regard to iron shipping, that the Committee were not so far wrong as has been alleged, when they insisted that evidence was wanting of iron ships being as safe as timber ones, under all sea-going circumstances. The question naturally suggests itself—Would any timber vessel have split so suddenly in two as the iron *Elberfeldt*? We think he would be a bold man who would give an answer in the affirmative. The case of the *Elberfeldt* is one which is evidently not met by the division of the vessel by bulk heads into different water-tight compartments. The great weight of the machinery amidships must have been the proximate cause of the calamity.]

"The *Elberfeldt*, under the command of Captain Stranach, sailed from the Brielle on the 22nd inst., at 50 minutes past 6 o'clock a.m., under light and variable winds. On nearing the English coast, Mr. Bush remarked to Captain Stranach that the ship's working appeared to be different from when they left Brielle, and that there was a strong vibration of the vessel. Scarcely had these remarks been made when the suspicions of Mr. Bush were but too truly confirmed; he begged of Captain Stranach to order the boat to be in readiness, for he was convinced that the vessel, being constructed of iron, would afford but a few minutes to save themselves. Whilst this conversation was taking place an indication of a plain nature gave warning that their fears were well grounded; for about 10 minutes to 3 o'clock p.m. she broke completely in half in the middle. Mr. Bush rushed up-stairs exclaiming, "It is now all over, stop the engines and out boat," and himself and two others fell headlong into the boat at the moment she was launched; the wind at this time was blowing a brisk gale. Mr. Bush then took the rudder of the boat and kept her head to wind as she was rowed stern foremost towards the vessel to save the remainder of the crew, and to which nautical manœuvre may be attributed the saving of those who were still upon the deck of the ill-fated vessel. The crew of the boat called out to Captain Stranach, who was on the

after-part of the wreck, to save himself by springing with an oar into the sea, as her head and stern were collapsing. This was a dreadful moment to all: the wreck presented a most awful, yet grand spectacle; the boiler, bursting by the collapse, threw up immense volumes of steam and fountains of water, and the vessel went down with a loud explosion. After her going down Mr. Bush looked around for the unfortunate crew, and one of the first he saw was Captain Stranach, struggling in the water, supported by a portion of the wreck. The captain and several others were with much difficulty taken into the boat. Three persons were unfortunately lost—two stokers named Wilson, father and son, and the cook, named Andrews. The number saved was 13, including Mr. Bush and Captain Stranach, who, after experiencing the greatest hardships for hours in an open boat, were picked up by the Charlotte, Captain Moyes, who humanely supplied them with dry clothes, coffee, soup, &c. Captain Stranach and Mr. Bush described the whole occurrence as a dream, for from her breaking to her going down not more than five minutes elapsed; and what but a short time before was considered a beautiful model of naval architecture was sunk irrecoverably in the ocean."

ON THE NUMERICAL SOLUTION OF EQUATIONS.—PART I.

Sir,—Enquiries have been frequent in your pages as to an easier method of extracting the cube root than the usual cumbrous and almost impracticable process. These enquiries have received a certain share of attention, but little of practical value has been elicited. Now there exists a method by which not only the square and cube roots, but also roots of all dimensions whatsoever, may be extracted by means of a perfectly simple and purely arithmetical process. I conceive, therefore, I shall be rendering an essential service to many of your readers by placing within their reach, through the medium of your pages, such a powerful instrument of calculation, which is not as yet nearly so well-known as it deserves to be.

The extraction of roots, in the ordinary sense of the term, is but a particular application of the method to which I refer. It is equally applicable to the numerical solution of equations of all orders; and it will conduce to perspicuity if I present it first, in this, its more general form.* I premise a few definitions.

1. An equation is designated as to order, degree, or dimension, according to the highest power of the unknown quantity which enters it. Thus, equations in which x, x^2, x^3, &c., are the highest powers, are called equations of the 1st, 2nd, 3rd, &c., degrees, respectively. Equations of the first four degrees receive also the distinctive appellations of simple, quadratic, cubic, and biquadratic equations, respectively.

2. An equation that contains all the integral powers of x, from the highest that enters it down to x^0, is called a *complete* equation of the order to which it belongs; but if any of the powers of x are wanting, the equation is said to be *incomplete*. Thus,

$$x^4 - 2x^3 + 4x^2 - 2x + 8 = 0,$$

is a complete equation of the 4th degree, since, x^0 being always $= 1$, the last term is $8x^0$; and $2x^3 - 3x + 7 = 0$ is an incomplete cubic equation. In the application of Horner's method of solution, incomplete equations must be rendered complete, which is done by supplying the missing powers, with zero for their co-efficient. Hence, for this purpose the last equation would be written, $2x^3 + 0x^2 - 3x + 7 = 0$.

3. Any number which satisfies an equation, that is, which, when substituted in that equation for the unknown quantity, renders the left-hand member $= 0$, is called a *root* of the equation. Thus, 5 is a root of the quadratic, $x^2 + 2x - 35 = 0$, and—7 is another.

* The *elements* of the method have been known for 200 years; but it is to the late Mr. Horner, of Bath, that we owe the improvement by which it has been rendered practically useful; and it has accordingly received the name of "Horner's Method." A full and interesting history of the problem, from the lucid pen of Professor De Morgan will be found in the Companion to the Almanac for 1839. And I may add here that all the knowledge of the method I possess is derived from the article INVOLUTION AND EVOLUTION, by the same writer, in the Penny Cyclopædia. To that article I would refer such as wish for a more profound view of the subject than can, for various and sufficiently obvious reasons, be here attempted.

P.S. Since the above note was written I have read Mr. Horner's paper, which is reprinted, from the Phil. Trans., in the Ladies' Diary for 1838. It contains an excellent synthetic view of the method; but it will be found much less generally intelligible than the article above cited.

I now present an example of the solution of an equation of the 4th degree. The equation is

$$x^4 - 80\,x^3 + 24\,x^2 - 6\,x - 80379639 = 0,$$

and the solution is as follows:—

1	— 80	+ 24	— 6	+ 80379639	100
	100	2000	202400	20239400	20
					3
	20	2024	202394	60140239*	
	100	12000	1402400	49225480	123 Root.
	120	14024	1604794*	10914759†	
	100	22000	856480	10914759	
	220	36024*	2461274	0	
	100	6800	1000480		
	320*	42824	3461754†		
	20	7200	176499		
	340	50024	3638253		
	20	7600			
	360	57624†			
	20	1209			
	380	58833			
	20				
	400†				
	3				
	403				

I have now to describe the steps. The co-efficients, 1, 80, 24, &c., are written down in order, with their proper signs, except the last co-efficient, 8037, &c., the sign of which is to be changed. Then, by trial, or by some of the methods described in works on the theory of equations, find the highest denomination contained in the root. Thus, in the case before us, if 100 be substituted for x, the result will be negative; and if 200 be substituted, the result will be positive. Hence, a root lies between 100 and 200. Place 100 therefore in the root. Begin now with the first co-efficient, viz. 1; multiply it by the number placed in the root, and add the result, viz., 100, to the 2nd co-efficient.‡ Multiply this sum also by 100, and add the result to the 3rd co-efficient. Multiply again by 100 and add the result to the 4th co-efficient. Multiplying once more this last sum by 100 we reach the last co-efficient; but here, in consequence of its sign having been changed, instead of adding, we must subtract. We thus attain the number 60140239, which I mark with an asterisk. Commencing again with the first co-efficient, the process is to be repeated, with the same multiplier, adding the products as found to the numbers now at the bottom of the several columns, and stopping this time at the next to the last column. The number 1604794 is thus attained, which I also distinguish by an asterisk. Again repeat the process, stopping at the 2nd column from the last, and distinguishing the number attained, viz., 36024, by an asterisk as before. The process is to be again repeated upon the single remaining working column, and 320, the number now at the bottom of that column is to be distinguished as before. This completes the ***first involution.*** The series of numbers now at the bottom of the several columns, being those distinguished by asterisks, with the addition of the first co-efficient, which remains unaltered, are to be treated in the same way as the original co-efficients,

‡ Of course, it will be understood, that a direction to add two numbers having different signs, is equivalent to a direction to subtract the less from the greater, prefixing to the remainder the sign of the greater.

for the purpose of finding the remaining parts of the root; and the learner may, if he pleases, bring them down into a line before proceeding farther. We have now this important advantage, viz., that the division (mentally) of the last number, 6014, &c., by the preceding 160, &c., will furnish us with an approximation to the next number to be placed in the root. Thus we see that 160, &c., is contained in 6014, &c., upwards of 30 times; but, by a mental anticipation of the effect of the next involution, it seems probable that 30 is too great. Therefore, place in the root the next lower number of tens, viz., 20, and proceed to involve as before, using this time 20 as the multiplier. The first step of this new involution brings us to 1091, &c., which I mark with a dagger. The second brings us to 3461, &c.; the third to 576, &c.; and the 4th to 400, all of which I also distinguish by daggers. This completes the *second involution*. The numbers now attained are to be treated as before; and we can, at this stage, depend upon the division of the last of them, by that which precedes it, giving us the number of the next denomination (in this case units) true to the nearest figure. We see at once that this quotient (viz., 1091, &c., by 346, &c.) cannot exceed 3. Place 3 therefore in the root, and involve as before, using 3 as the multiplier. The first step of this involution, which it is therefore unnecessary to complete, shows us that the root is attained, by reducing the number in the last column to zero; and the root is, as may be easily verified, $100+20+3=123$.

This process, although somewhat tedious in description, is in reality extremely simple, as will be found upon trial; for any one who wishes to master it must not rest satisfied with looking at it, but must take pen in hand for himself. The only difficulty is in the outset, viz., in finding the number of the highest denomination in the root.* But this difficulty can always be surmounted, as already hinted, by means of considerations supplied in the Theory of Equations. Moreover, those who do not possess the advantage of being acquainted with this theory, should be aware that, the primary object of the successive involutions being to render the number in the last column $= 0$, any numbers placed in the root and used as multipliers will have this effect, provided their sum be equal to a root of the equation. Thus, if, instead of using in the foregoing example the numbers 100, 20, and 3, we had taken 200, —50, —20, and —7, we should have had the same result: the number in the last column would have been reduced to zero, and $200-(50+20+7)=123$ as before. The method taken is the shortest, and leads most directly to the result.

To show that this view, in part at least, is correct, I shall take the last example in the state in which it is left on the completion of the first involution; and it will be seen that the same result is attained by using, in the succeeding involutions, other numbers than those employed above.

					Part of Root found = 100
1	+ 320	+ 36024	+ 1604794	+ 60140239	30
	30	10500	1395720	90015420	−7
	350	46524	3000514	29875181†	123 Root.
	30	11400	1737720	29875181	
	380	57924	4738234†	0	
	30	12300	−470351		
	410	70224†	4267883		
	30	−3031			
	440†	67193			
	−7				
	433				

And $100+30-7=123$, the root before found.

* It will be seen hereafter, that in the application of this method to the extraction of roots, usually so called, the difficulty here referred to does not exist.

The equation solved is of the 4th degree; but the very same mode of conducting operations applies equally to the solution of equations of all degrees. The only difference as regards the degree of the equation is, that an increase in the degree causes a corresponding increase in the number of working columns; and a decrease in the degree causes a like decrease in the number of the working columns.

I shall conclude this paper with an example of the solution of a cubic equation, being one which falls under Cardan's irreducible case. But this offers no obstruction to the application to it of Horner's method.

Required a root of the equation

$$x^3 - 242\,x^2 - 6315\,x + 2577096 = 0$$

1	− 242	− 6315	− 2577096	100
	100	− 14200	− 2051500	20
				3
‡ 98	− 142	− 20515	− 525596*	
20	100	− 4200	− 463100	123 Root.
118†	− 42	− 24715*	− 62496†	
3	100	1560	− 62496	
121	58*	− 23155	0	
3	20	1960		
124	78	− 21195†		
3	20	363		
127**	98	− 20832		
		372		
		− 20460**		

After the explanation with which the former example was accompanied, the preceding seems to call for no remark. It must be noticed, however, that I have in this example completed the third involution, although this is not necessary to the finding of the root 123. The reason for doing so will hereafter appear.

In both the examples I have given the roots found are rational, that is, expressible in finite terms. In nearly all the cases that would occur in real practice, however, this will not be the case. It is in its application to the finding of irrational roots, whether of pure or adfected equations, that the advantage of Horner's method of solution chiefly appears. This I purpose to show in another paper.

I am, Sir,

Yours respectfully,

G.

Hermes-street, Pentonville, February 17, 1844.

BESSEMER'S GOLD PAINT.

[From a paper on the subject in the *Liverpool Mercury* of Feb. 23.]

In the applications of gilding and bronzing for ornamental house-work two very different processes are adopted. The first requires the employing of pure gold leaf, e al in fineness to $\frac{1}{282000}$ of an inch; and gi s rise to the two methods—one called G *Gilding*, comprising about a dozen o rations from first to last; the other k wn as *Burnished*, or *Distempered Gild-i* , which, performed in its best style, oc- c ies about half as many more processes as t former for its completion. We may h e, at once, perceive that the expense of both these methods is materially enhanced by the amount of time consumed in their performance.

Bronzing does not strictly belong to this division of the subject, but a bronze powder is often employed, which is rather imitative of gold than of antique bronze. Its use to imitate bronze castings is well understood, by a slight gilding of a few prominent portions, which, tastefully applied, greatly enriches ornamental cast-iron work, statuary, &c.

We come next to consider the procuring

‡ The first column being always blank, with the exception of the co-efficient at the top, part of the s ining column is here put in it to save space.

of these precious materials. It may not be generally known that such has been the encouragement long given to the art of gilding in Germany, that we were more early, and have since continued to be, extensively supplied with the bronze powders from Germany, which still find a good market in London, as also in Birmingham and other manufacturing districts engaged in fabricating ornamental metal and japan work, and similar articles of taste and *virtù*. The foreign markets reap, therefore, the benefit of both their home and foreign trade, while we have been hitherto almost wholly dependent on them, as much from prejudice as from custom. So much has this been the case with our tradesmen and artists hitherto, that it is a well-ascertained fact that, although the English manufacture of these articles has of late been brought to a high state of perfection, and is now even approved on the Continent in preference to their own, both for excellence and cheapness, yet, to accommodate English fastidiousness, the English is frequently only disposable through the medium of the German dealer, to whom is often paid fifty per cent. and upwards over what it might have been purchased for in the metropolis from the manufacturer! It is almost incredible that prejudice should so strangely warp the judgment of many of our traders and artists; and it would really appear that the fact has only to be known, and exposed in all its glaring absurdity, to be exploded, and *that* encouragement given to British arts and British skill, of which we are too apt to lament the absence or the decline, though often on the most vague, superficial information. Improvement in art or science is effected by the united efforts of many, which can only be sustained by proper encouragement given, but which cannot be expected to result, from the folly of constantly charging on the present age the weaknesses of the past, as if science stood still, or was circumscribed by soil or climate. What it is possible to manufacture on the Continent, it is surely possible to manufacture in our own island; yet past experience has afforded the fullest evidence, practically, of this simple fact having long been most obstinately doubted and disputed against the strongest evidence to the contrary.

The creating of a new art, or the adding of another branch to an existing one, must always excite considerable interest. I have no hesitation in pronouncing this to have been effected in regard to painting as a decorative art, by a remarkable and truly beautiful and ingenious application, known as gold paint, of which Mr. Henry Bessemer, St. Pancras-road, London, is the inventor and patentee, by the use of which all the gorgeous and rich appearance of gilding is produced with wonderful despatch, at an amazing reduction of cost. I consider that the gilding of the dome of St. Paul's would cost little less than a thousand pounds, whereas all the brilliancy and lustre of the leaf gold may be obtained by employing the gold paint, as it is very appropriately called, for an expense short of £200. Mr. Bessemer, who is deservedly distinguished as a bronzist, has, by his highly improved manufacture of bronze powder, greatly reduced its price, yet at least one-half of that article continues to be purchased from the German dealers.

The introduction of the gold paint will now, however, more than enable us to compete with the continental manufacturer; for we may be well assured, that by their present means, nothing compared with it for fineness and effect, can be produced in the foreign market. The better to understand the value of the new process, which, in fact, will become a new and highly ornamental branch of painting, the principal objection to the use of bronze powders, for such purposes, may be enumerated.

In the first place, we find that when an attempt is made to imitate gilding by bronzing cornices, mouldings, carvings, and similar work, there is a deadness of effect,—a want of brilliancy;—secondly, some difficulty is experienced in applying powder to large fixed objects, without its falling about the apartment, occasioning waste, while great care is requisite to guard against its spoiling whatever of furniture is in its neighbourhood;—and lastly, not the least consideration is, the cost of preparing surfaces with gold size, as for gilding, requiring the utmost management in the after application of the powder, to avoid its becoming oxidized by being fixed on the surface of the varnish, unprotected from atmospheric influence.

The gold pigment obviates every objection that has been raised to other methods of imitative gilding. Its preparation involves the employment of very curious and elaborate machinery, by which an impalpable metallic powder is produced of singular beauty. Its application to plaster, papier maché, wood, plain or painted frames, or whatever it is required to cover with the composition, is effected simply by using a camel-hair pencil, which is to be dipped into a little of the powder and rubbed up in a small portion of a transparent gummy varnish, prepared and supplied for the purpose, by which it is made firmly to adhere to whatever it is laid on, after the common method of applying paints.* Thus may be seen how much this

* The printed directions state, "Put a small quantity of the metallic powder into a china ink saucer, add as much of the liquid as will render

process differs from that of bronzing, and how successfully is avoided all waste or risk of spoiling furniture. The ease and simplicity of the process is likewise no small recommendation, requiring no previous preparation of the ground; one coat will even cover black paint, or mark a sheet of writing paper, though for finer and richer work two coats may be applied.

Much as Mr. Bessemer deserves our esteem for the skill he has displayed in perfecting this ingenious invention,—for we may now emulate Paris and other continental cities in their elaborate and profuse display of internal and external gilding, with no doubt equal effect, at less expense; but in an especial manner has he contributed by this means to benefit a large class of the community, painters, in almost every branch of the art. At no very distant period we may, therefore, expect to see a complete change effected in ornamental gilding by this additional gift of science.

INSTITUTION OF CIVIL ENGINEERS.
MINUTES OF PROCEEDINGS, SESSION, 1844.

January 9.

"*Description of cast and wrought iron trussed-girder Bridges on the line of the Bishop Auckland and Weardale Railway.*" *By John Storey.*

The author states, that his attention has been long directed to the expensive construction of the brick and stone bridges, usually erected over and on the line of railways, and the apparent want of durability in the timber bridges, which have in some instances been substituted; as well as to the cast-iron bridges, which have generally been constructed in situations where the height between the top of the rails and the level of the roads which they span, was so limited, as not to admit of a stone or a brick arch. In the latter cases, cast-iron girders have been employed, but their great weight has rendered them expensive, and has obliged the abutment piers for supporting them to be very substantial.

In order to obviate these objections, the author has introduced combinations of cast a l wrought iron in forms, which he cont ds, may be advantageously adopted for o upation bridges, or even for carrying the r way, and that they may be constructed at a ss cost than stone, brick, or even timber b lges.

it ather more fluid than common paint; give a ight stirring with the brush, and it will be fit fi use. It must be mixed in small quantities, say a it a drachm of each, and a slight motion given t e paint each time a fresh supply is taken with tl rush; a fitch pencil is found to answer best."

These bridges consist of longitudinal and segmental girders of cast iron, abutting against each other at the ends, secured together by bolts and nuts through the flanches, and resting on masonry abutments: a system of wrought-iron tie-trussing is then applied, and struts are placed at certain distances where they are requisite. As many of these principal trusses are used as the strength of the bridge demands, and they are connected by transverse braces and distance pieces of cast iron, thus preventing undue outward pressure; sockets are cast upon the girders, to receive the timber joists, and the platform is covered with Dantzic deal planking spiked to the joists. The wrought-iron struts at the top, clasp the girders to which they are also firmly bolted, and their lower extremities pass through the truss, so that on the nuts being screwed up, the truss is brought to its proper degree of tension, and being made sufficiently strong to bear the weight calculated for the bridge, independent of the segmental girders, the weight and strain are brought upon the abutments in the most favourable manner.

Bridges thus constructed do not require any centring for their erection, as each side may be put together near the spot, and by means of purchases may be lifted entire on to the abutments, or the whole bridge may be put together before the earth is excavated from between the abutments, excepting only as much as is necessary for receiving the trussing.

The dimensions are given of occupation bridges, calculated to bear eight tons, which is stated to be greater weight than is required by the landowners, the total weight of cast and wrought iron in an oblique bridge of a span of 86 feet 3 inches, and 11 feet wide, is 11 tons 7 cwt., and that of a square bridge of 106 feet 6 inches span, and 11 feet wide, is 14½ tons: their total cost, including excavating the ground, the masonry, stone penning on the sides of the excavations beneath the bridge, the timber work and the painting, was, for the former 280*l.*, for the latter 342*l.* These sums are stated to be much less than the expense of similar bridges of stone or even of timber.

A design is given of a stronger kind of bridge of similar construction for carrying two lines of railway. The span is 90 feet, and the width 22 feet, between the side railings: the weight is 43 tons, and the total cost, including the masonry, is estimated not to exceed 1,200*l.* It is calculated to bear about 50 tons, which is as much as could be brought upon it by any passing train.

The author proposes to adapt this system of construction to bridges for crossing rivers, &c., in order that by the lightness of the

piers, and their having to bear only a vertical thrust, the water-way may be less impeded than it is at present by the usual heavy stone structures.

A design is also submitted for a bridge, to consist of parallel cast-iron girders, trussed with wrought-iron bars, in such a manner as to convert the depth of the girder into a strut, the weight of the passing load being entirely resisted by the tensile strain of the bars.

The author does not claim the introduction of wrought-iron trussing for cast-iron girders, as he is well aware of its being constantly practised; but he believes that it has not been commonly done to the extent which he proposes, and being satisfied of the practical utility of the system, he was desirous of bringing it more prominently under the notice of engineers through the medium of the Institution, and also of inviting discussion upon the plan, one great merit of which is, that it uses a material produced in this country, better and cheaper than elsewhere, and assists one of its staple manufactures, which is at this moment much depressed.

The communication is accompanied by five drawings of bridges, (Nos. 3409 to 3413,) fully illustrating in detail the various modes of construction treated of.

Captain Moorsom stated, that occupation bridges of 60 feet span by 18 feet in width, could be constructed of timber for 5*l.* per lineal foot, including the cost of the excavation, the masonry of the abutments, &c.; that up to 90 feet or even 120 feet span, the expense would not exceed 4*l.* per foot. He preferred timber bridges for railways, not only on account of their simplicity and the facility of repairing them, but also because a good deal of the small timber, which would otherwise be wasted, or used at a loss, might be made available for such bridges, and thus a useless expenditure for materials was avoided.

Mr. Grissell was also of opinion, that timber bridges could be constructed more cheaply than those of iron, as recommended in the paper. So much wrought iron would, he apprehended, materially increase their cost.

"*Description of a Cast-iron Bridge, completed in the year* 1840, *for carrying the Birmingham and Gloucester Railway over the River Avon, near Tewkesbury.*" *By Captain W. S. Moorsom, Assoc. Inst. C.E.*

This bridge is situated about seven miles north of Tewkesbury: the approaches to it are formed on embankments about 25 feet high, crossing the valley nearly at right angles. In the construction it was desirable to provide for the effect of considerable floods, by aiding the egress of the water, and also to avoid any interference with the navigation of the river; a greater width of water-way was therefore given, than at first view may appear necessary.

The bridge consists of three segmental arches, each of 57 feet span, with a versed sine of 5 feet 2 inches; the length between the centres of the piers being 66 feet 6 inches; the total width between the abutments 190 feet 6 inches; and the breadth of the cut-waters 8 feet 6 inches each, leaving a clear water-way of 173 feet 6 inches.

The principal novelty in the work is the method of constructing the two piers. They are formed externally of cast-iron plates or caissons, filled for the first 12 feet from the bottom with solid masonry and concrete; upon this is built hollow masonry to support the cap-plates, carrying eight pillars on each pier, with an entablature, for receiving the ends of the arches, which, with the caps, pillars, and entablatures, are of cast-iron. The abutments at either end are of masonry.

The caissons are, at the bottom, 41 feet 6 inches long, and 16 feet wide, with semicircular ends, tapering upwards for 12 feet, on all sides, to 34 feet 6 inches long, by 8 feet 6 inches wide, from whence they rise perpendicularly for the remaining 8 feet 9 inches. They are constructed of cast-iron flanched plates, ¾ inch thick, screwed together by bolts, and the joints made with iron cement. The total weight of each caisson is about 28 tons.

The bottom of the river, at the site of each pier, having been prepared by a scoop dredger, worked from a platform erected upon piles, the lower row of plates for the caisson was put together, and suspended in the water by iron rods, while the other rows were added, gradually lowering the whole as the work proceeded, until the bottom rested on the bed of the river; a quantity of clay was then thrown round the outside, which formed a joint so impervious to water, that with two pumps, each of 5½ inches square, the caisson was emptied in six hours, and was afterwards kept dry by one pump, which was worked occasionally during the subsequent excavations withinside the caisson.

The dimensions of the cast-iron work of the arches and the masonry of the abutments, are given in detail, with an account of the methods of construction followed, and of the materials employed.

It is stated that these iron caissons, which were proposed by Mr. Ward of Falmouth, the resident engineer, were found to be cheaper than having coffer-dams and stone

piers. The total cost of the bridge, including iron-work, painting, masonry, subsequent repairs to the walls, and superintendence during construction, being 10,192*l.*, and the weight of cast and wrought iron employed was about 520 tons.

The partial failure of an arch in one of the abutments is described, and the supposed reasons for the sinking are given, with the means which were adopted for replacing those stones which had been displaced, and it is stated that no sinking has since occurred.

The paper is illustrated by eighteen remarkably well-executed drawings (Nos. 3426 to 3443) by Mr. Butterton.

Captain Moorsom said that there were a few interesting particulars relative to the bridge, beyond those which were given in the paper. Mr. Murchison showed, in his work on the Geology of the Silurian districts, that the deposits of gravel of the Lickey range of the hills nearer to Birmingham, and that of the Avon near Pershore, were, geologically speaking, identical; but Captain Moorsom found that, as regarded the engineer's operations, they differed in character.

The gravel in the neighbourhood of Birmingham was remarkable for the rounded character of the stones composing it, whereas that which was found in the neighbourhood of this bridge consisted almost entirely of angular stones, which were used without any admixture of sand, for making concrete, which was found to become most compact when the stones were perfectly clean; but the Birmingham gravel required a certain proportion of sand with it, to make compact concrete.

In excavating for the foundations of the abutments, several bones of deer, and a human skull were found, at depths from 10 to 14 feet below the level of the bottom of the river.

The circumstances attaching to the partial failure of the small southern abutment arch were peculiar. It had been supposed to arise from the expansion of the iron-work taking place all in one direction, but after watching the arch for six months, he thought such an opinion was, to a great extent, unfounded; and he conceived it to have arisen partly from the abutment wall having slightly sunk at the back, owing to the great quantity of rain which fell at that period, affecting the spongy soil upon which it was built.

For seven months the valley of the Avon, at the spot in question, was (with a very few days' intermission) under water, immediately after the wall had been built, and before the bridge was nearly completed. An amount of sinkage which was scarcely perceptible in the back of the foundation of the wall, would have the effect of displacing the stones of the arch to the extent of some inches, and it was to this cause that he attributed the separation of the arch stones. As soon as the settlement appeared to have ceased, the defective stones were taken out and replaced, without interrupting the passage of the trains.

The north-eastern wing wall also failed from the same cause, viz., the spongy nature of the soil when it was thoroughly saturated with water; and if this had been foreseen, prevention would have been easy, by placing a firmer and more extended base of concrete under the footings of the wall.

He thought that the method of forming the piers, was as good and as cheap, as any known mode that could have been adopted; but if he had to build another bridge of the same dimensions, and under similar circumstances he would not use cast-iron, but would construct it of timber, not on account of any engineering difficulty, but simply because a timber structure would be very much cheaper, and equally serviceable for the purposes of the railway, taking into account comparative durability as well as present cost.

"*Description of a wrought-iron Lattice Bridge, lately erected on the line of the Dublin and Drogheda Railway.*" *By G. W. Hemans, Grad. Inst. C. E.*

This kind of bridge is stated to have been first used in America, where timber being so abundant, the lattice sides are formed of that material, and consist simply of planks three inches thick, crossed so as to form deep beams, and secured with oak trenails at all the intersections.

The bridge described in this communication, is situated about three miles from Dublin, over an excavation of 36 feet in depth; its span is 84 feet in the clear, and the two lattice beams are set on edge parallel to each other, resting at either end on plain stone abutments built in the slope. These beams are 10 feet in depth, and are formed by a series of flat bars of wrought-iron, 2½ inches wide, and ⅝ inch thick, crossing each other at an angle of 45°. At a height of 5 feet 6 inches above the bottom edge, transverse bearers are placed, formed of ½ inch angle-iron, 6 inches deep, and set 2 feet apart, similar to the cross ties now used for the decks of iron steam-vessels, and upon these the planking for the roadway is fastened.

The account of the mode of construction, and of the raising and fixing the lattice-beams, by Messrs. Perry of Dublin, the contractors, is given in detail.

The author states that some deflection or sagging of the lattices was expected, and was provided for, by constructing each of them with a camber or gradual curve from the ends, amounting to 12 inches in the centre; but that far from such being the case, they did not sink even when heavy weights passed over them.

The total cost of the bridge, including the masonry of the abutments, was 510*l.*

The paper is illustrated by a drawing, (No. 3408,) showing the elevation and the details of the construction of the bridge.

Major-General Pasley had seen and approved the bridge; it appeared to be on a good principle, and was well constructed. He understood that it had been Mr. Macneill's intention to have a model made of a viaduct of 230 feet in length, with a central span of 140 feet, which he had designed for carrying the Dublin and Drogheda Railway across the Royal Canal in an oblique direction, but he now considered that the bridge which had been described was better than a model; and as it had borne, with only a slight deflection, a loaded wagon weighing 22 tons, and all other tests to which it had been submitted, he had decided upon building the larger bridge upon the same principle.

Captain Moorsom thought that the bridge was too expensive, and that if the lattice side had been 8 feet 6 inches in depth, they would have been quite strong enough. In the timber bridges of the same construction in America, any tendency to either flexibility or buckling was obviated by placing several ranges of lattices side by side, and the custom of roofing the timber bridges of that country also gave additional strength laterally. The timber bridges on this principle which he had constructed on the Birmingham and Gloucester Railway (one of which was 160 feet span, and the others between 90 and 120 feet span), varied in cost from 4*l.* to nearly 6*l.* per running foot, according to the span, the larger spans being proportionally less expensive than the smaller. Materials and labour were dear at the time of constructing the bridges alluded to.

The President hoped that the good example set by Mr. Hemans in sending this account of a portion of the work committed to his charge, would have the effect of inducing other graduates to send papers to the Institution; and he was sure it would prove advantageous to them in causing their talents to be appreciated among the senior members of the profession.

SCREW PROPELLING.—MR. GRANTHAM'S PLAN.

The paper by Mr. Grantham on screw propelling which was read at the Institution of Civil Engineers, on the 13th ultimo, (see last No. of *Mech. Mag.*, p. 124,) was followed by a discussion on the subject, which has been continued for three successive evenings to the exclusion nearly of all other business.

Mr. Grantham stated on the second evening that his object was not so much to point attention to the construction of the vessel which had been at work in Liverpool, as to illustrate an important fact which his experiments had brought to his knowledge, namely, that a propeller might be constructed of such dimensions that the number of revolutions it would be required to make to obtain a high velocity, should not much exceed those of the ordinary paddle-wheel; whence he deduces this conclusion, that the usual condensing marine engine might be applied direct to the propelled shaft, not requiring the intervention of spur wheels or bands, which are at present considered by many engineers as insuperable objections to the general adoption of screw propelling.

Mr. Grantham has obtained a patent for this arrangement, and is now urging his claims on the Government, for whose service it promises to be of the first importance, as it admits of the whole of the engine power being placed entirely below water.

A VISITOR.

SCREW-PROPELLING—MR. SMITH'S CLAIMS —THE "RATTLER" EXPERIMENTS, ETC.

Sir,—As a constant reader of your useful Magazine, and feeling a great interest in whatever relates to a subject of such growing importance to this country as steam navigation, I was very sorry to observe the general tone in which you speak of Smith's labours in that way, in your article "Progress of screw-propelling."

Looking back only from 8 to 10 years, the application of the screw to any useful purpose of propelling was thought so visionary a thing, that even the most eminent of our engineers would scarcely give any at-

tention to it; and it is but an act of bare justice to Mr. Smith, to claim for him the merit of having, through his strong faith in the value of the invention, laboured at it, through the most adverse circumstances and discouraging difficulties, until he at length succeeded in proving its utility; first, through the instrumentality of a small boat and engine constructed by himself; and secondly, by means of the *Archimedes*, which demonstrated, beyond any doubt, the certainty of its useful and successful application.

The proposal of applying a screw to the propelling of vessels dates far back, and is an *idea* that has long been familiar to the minds of most persons conversant with steam machinery, but only entertained by them in that way; and I contend that the public are altogether indebted to Mr. Smith for its adoption *now*, whatever might have taken place at a later period; and this meagre meed of praise is, at least, justly due to him.

In adverting, in the article before referred to, to the comparative speed of the *Prometheus* and *Rattler*, I differ from you in thinking that, because the river boats are so much faster than the *Prometheus*, there can be but little merit in the superiority of the *Rattler* over her. The river boats are built for a very uniform draught of water, which renders it an act of inexcusable ignorance and culpability combined, not to arrange the paddle-wheels and paddles in such a manner as to ensure the best possible result as regards their action; and the vessels and engines, even those that go at what I call the high speed through the water of 12 miles an hour, are constructed as light as possible; the former of a form adapted expressly for high velocity in smooth water, and the latter of the most improved efficiency.

On the other hand, the *Prometheus* and *Rattler* are necessarily heavy-built vessels, formed for warlike purposes, and for encountering the sea; so that neither of them can, with any fairness, be compared, as regards speed, to river boats.

The trials of the *Prometheus* and *Rattler* took place at their mean draught of water, as I have been informed, and consequently under circumstances when the paddle-wheels of the former might be supposed to act best, so that anything beyond an equality of speed between these vessels speaks volumes in favour of the screw, more especially when looking to its great superiority in bad weather, and at variable draughts of water, such as must ever be the case in long cruises or voyages where much fuel is consumed.

For such a vessel as the *Prometheus*, the speed you name of 8·757 knots = 10·14 statute miles per hour, must be considered a good speed at her mean draught.

Allow me to add in conclusion, that looking to the progressive improvement of our river boats, it presents to my mind an object of as great interest as can well be; for it is certainly here that most of the improvements in the construction of steam-vessels and the machinery for them must originate with, and have the advantage of being under the immediate observation of the constructors.

This leads to regret as affecting the real progress of improvement, when one sees such exaggerated statements as the pages of your Magazine sometimes present, respecting the actual speed of the river Thames steamers.

Your own statement (in the article "Progress of Screw-propelling"), of our river steamers having accomplished 15 miles per hour through the water, is within what has been done by the swiftest of them, none of which, except it may be the *Isle of Thanet*, having yet reached quite 16 miles per hour through the water. Now to step from this to 18½ miles, even as the best going of the *Isle of Thanet*, should not be established as a fact to quote from, without more precise information than is afforded by the letter of Messrs. J. and F. Napier, (which follows the article "Screw-propelling" in your last Number,) who do not say they had acquired their knowledge from an actual trial at Long Reach, or any other equally accurate method; and as their letter intimates that in the trial with the *Prince of Wales*, the engine went only 32 to 35 strokes per minute instead of 44, while they state that the vessel was not going much beyond half-speed, one may reasonably, after observations so opposed to each other, be inclined to doubt the accuracy of the 18½ miles per hour without clear information on the subject.

Having no object in view in this letter, but to attempt to convey and establish the truth in regard to important matters, I hope you will accept it in that spirit, and excuse its length.

I am, Sir,
Your obedient servant,
OBSERVER.

London, February 28, 1844.

[We have never questioned—never having had occasion to question—the value of the services rendered by Mr. Smith in the introduction of screw-propelling. All that we have said, and still maintain, is, that Mr. Smith himself *invented* nothing. The whole of his merit, in our opinion, consists in his having taken up an old and *not forgotten* scheme, of which he had manifestly at first

the vaguest notions possible, and, with the help of an eminent engineering firm, and some adventurous men of money, turned it to a successful account. To Mr. George Rennie and to Mr. Wright, the banker, the cause of screw-propelling is even more indebted than to Mr. Smith.—ED. M. M.]

THE DUNDONALD CASE, AND THE NEW BILL FOR THE AMENDMENT OF THE LAW OF PATENTS.

The shape which the movement now making in the House of Lords on behalf of the Earl of Dundonald has taken, is that of a general Bill for the Amendment of the Law of Patents, in so far as regards the extension of patents beyond the period to which they are now limited—of which Bill, when passed into a law the noble lord may avail himself. As in the case of the late extension of literary copyright, where the immediate purpose of the promoters of the measure was, notoriously, to serve the family of Sir Walter Scott, so, in this analogous one of copyright of inventions, the ostensible object is the public good —the real one to do a good turn for the gallant Earl of Dundonald.

As the law now stands, the Crown may, on the recommendation of the Privy Council, grant an extension of letters patent for *any period not exceeding seven years* beyond the original term of fourteen. Lord Brougham now proposes that the extension should be for any period *not exceeding fourteen years.* We see no objection whatever to such an alteration of the law, and, for the reasons given in our last, we do not suppose that any one will grudge Lord Dundonald the utmost advantage he can *legitimately* derive under it. All that is to be feared is, that the granting of an extension, for any extraordinary period, of the patent for his rotary engine, may confer upon the invention, in the eyes of incomptent judges, a degree of value which it does not really possess.

The *mode* in which Lord Brougham proposes to carry the projected change into effect, is of a singularly roundabout description, and must, unavoidably, be excessively costly. The Bill, after reciting that it is "expedient for *the farther encouragement of inventions in the useful arts*, to enable the time of monopoly of patents to be extended in cases in which it can be satisfactorily shown that the expense of the invention has been greater than the time now limited by law will suffice to reimburse," proceeds to enact, That any patentee of an invention shall be at liberty, before the expiration of his patent, to present a petition to either House of Parliament, setting forth that he has been unable to obtain a *due* remuneration for his expense and trouble in perfecting such invention—that if the matter of such petition be then proved before a committee of such House, or at the bar thereof, or otherwise, her Majesty is to be addressed on the subject, and shall, if she see fit, refer it to the Judicial Committee of the Privy Council—and that if such Committee, after investigation into the matter, report that a period greater than the seven years' extension of the said patent ought to be granted, her Majesty is empowered to grant such extension for any period not exceeding fourteen years."

What occasion can there be for any such previous parliamentary investigation? Why not go before the Privy Council at once for a fourteen years' extension in the same way as in the case of one for seven years? What more, indeed, was wanted than a simple enactment that the power of the Crown to extend patents on the recommendation of the Privy Council, should be enlarged from seven to fourteen years? There can be no better tribunal for the investigation of such matters than the Privy Council, nor any more unfit for the purpose than so popular and party-swayed a body as the House of Commons. Of the House of Lords we need say nothing, for there the jurisdiction would devolve, as a matter of course, on the Law Lords; except this, that as the Law Lords are the most active members of the Privy Council, to refer a report of theirs to the Privy Council, would be only to have a matter tried twice over by the same judges, for no other object than that of compelling the poor, unrequited inventor to pay twice as much as there is the least occasion for.

So much for this new plan for the "*encouragement* of inventions in the useful arts."

LIST OF ENGLISH PATENTS GRANTED BETWEEN 27TH OF JANUARY AND 24TH OF FEBRUARY, 1844.

Robert Johnstone, of Baker-street, Middlesex, gent., for improvements in the construction of lamps for the combustion of naphtha, turpentine and other resinous oils. January 27; six months.

Henry Vernon Physick, of Bath, civil engineer, for certain improvements applicable to machinery for driving piles. January 30; six months.

William Edward Newton, of Chancery-lane, civil engineer, for improvements in the preparation of caoutchouc or India rubber, and in manufacturing various fabrics, of which caoutchouc forms a component part. (Being a communication.) January 30; six months.

Ezra Washington Burrows, of Swinton-street, St. Pancras, civil engineer, for certain improvements in the construction of engines for producing and communicating motive power by the elastic force of steam, or by manual or animal labour. January 30; six months.

George Miller Clark, of Albany-street, Regent's-park, tallow chandler, for improvements in night lights, and in apparatus used therewith. January 30; six months.

William Lucas Sargant, of Birmingham, for improvements in the manufacture of barrels for fire-arms. (Being partly a communication.) January 30; six months.

Baptiste Buret, of Leicester-square, merchant, and François Marius David, of the same place, manufacturer of gas apparatus, for improvements in the manufacture of gas. Jan. 30; six months.

William Fletcher, of Moreton-house, Buckingham, clerk, for certain improvements in the construction of locks and latches applicable for doors and other purposes. January 30; six months.

James Silcock, of Birmingham, engineer, for certain improvements in planes. January 31; six months.

Robert Hodgson, of Princes-street, Clapham-road, Surrey, engineer, for improvements in propelling vessels, and in the machinery for working the same. February 2; six months.

William Sangster, of Regent-street, Middlesex, umbrella and parasol manufacturer, for improvements in umbrellas and parasols. February 6; six months.

Benjamin Aingworth, of Birmingham, gent., for certain improvements in manufacturing buttons for wearing apparel. February 6; six months.

Thomas Southall, of Kidderminster, druggist, and Charles Crudgington, of the same place, banker, for improvements in the manufacture of iron and steel. February 8; six months.

James Johnston, of Willow-park, Greenock, esq., for improvements in steam boilers. February 8; six months.

Christopher Nickels, of the York-road, Lambeth, gent., for improvements in the manufacture of crape, or substitutes for crape. February 8; six months.

Ezra Jenks Coates, of Bread-street, Cheapside, merchant, for improvements in apparatus for facilitating the reduction of fractures, dislocations of bones, and for maintaining their parts in their just positions. (Being a communication.) February 8; six months.

Charles Wheatstone, of Conduit-street, Hanover-square, gentleman, for improvements on the concertina and other musical instruments, in which the sounds are produced by the action of wind on vibratory springs. February 8; six months.

John Cox, and George Cox, of Gorgie Mills, near Edinburgh, manufacturers of leather and gelatine, for improvements in the manufacture of leather and gelatine. February 8; six months.

George Straker, of Newcastle-upon-Tyne, ship-owner, for a certain improvement, or certain improvements in ships' windlasses. February 8; six months.

Edwin Sheppard, of Manchester, foreman in the works of Messrs. G. C. Pauling and Co., contractors and builders, for certain improvements in machinery or apparatus for planing, sawing, and cutting wood, and other substances. February 8; six months.

William Edward Newton, of Chancery lane, civil engineer, for a new or improved system or apparatus for obtaining and applying motive power for propelling on railways or water, and for raising heavy bodies, applicable also to various other purposes where power is required. (Being a communication.) February 8; six months.

Joseph Gibson, jun., of Birmingham, japanner, for improvements in ornamenting glass. February 10; six months.

Henry Hawes Fox, of Northwoods, Gloucester, doctor of medicine, for an improved mode of constructing fire-proof floors, ceilings, and roofs. February 10; six months.

William Geeves, of Little Portland-street, cork and cork gun wadding manufacturer, for improvements in prepared wood for lighting or kindling fires. February 12; six months.

William Edward Newton, of Chancery-lane, civil engineer, for an improvement or improvements in furnaces. (Being a communication.) February 12; six months.

Job Haines, of Tipton, Stafford, coal master, and Richard Haines, of the same place, coal master, for an improved method or methods of making or manufacturing links for the construction of flat chains, used for mining and other purposes. February 13; six months.

Bennet Woodcroft, of Manchester, consulting engineer, for improvements in propelling vessels. February 13; six months.

James Overend, of Liverpool, gentleman, for improvements in printing fabrics with metallic matters, and in finishing silks and other fabrics (Being a communication.) February 13; six months.

Andrew Kurtz, of Liverpool, manufacturing chemist, for certain improvements in apparatus to be employed for drying, evaporating, distilling, torrefying, and calcining. February 12; six months.

Elijah Galloway, of Union-place, City-road, civil engineer, for certain combinations of materials to be used as a substitute for canvas, and other surfaces employed as grounds for painting, and some of which combinations are applicable to other purposes. February 14; six months.

Samuel Dobree, of Putney, Surrey, esquire, for certain improvements in the manufacture of fuel. (Being a communication.) February 17; six months.

John Lionel Hood, of Old Broad-street, gentleman, for an improved composition, or mixture of metals, applicable to the manufacture of sheathing for ships and other vessels, bolts, nails, or other fastenings. (Being a communication.) February 17; six months.

John Kibble, of Glasgow, gentleman, for improvements in transmitting power in working machinery where endless belts, chains, or straps are or may be used. February 17; six months.

William Losh, of Newcastle-upon-Tyne, esquire, for improvements in the manufacture of metal chains for mining and other purposes. February 17; six months.

Alexander Alliott, of Lenton, bleacher, for improvements in fulling, stretching, drying, and dressing goods manufactured of wool, cotton, silk, and other fibrous materials. February 19; six months.

Caleb Bedells, of Leicester, manufacturer, for improvements in the manufacture of elastic fabrics. February 19; six months.

Christopher Nickels and Benjamin Nickels, of York-road, Lambeth, manufacturers, for improvements in the manufacture of elastic fabrics, and in rendering elastic fabrics less elastic. February 19; six months.

Alfred Jeffery, of Brunton works, Limehouse, for improvements in treating wood, and certain other

substances required to be exposed to water. February 19; six months.

Alexander Parkes, of Birmingham, artist, for improvements in the manufacture of certain alloys or combinations of metals, and in depositing certain metals. February 21; six months.

William Sheldon, of Birmingham, japan painter, for improvements in the manufacture of buttons and in japanner's ware, and articles in substitution of papier-maché. February 21; six months.

Ezra Jenks Coates, of Bread-street, Cheapside, merchant, for improvements in the forging of bolts, spikes, and nails. February 21; six months.

Henry Charles Howells, of Hay, gentleman, for improvements in the fastenings of parts of bedsteads and other frames. (Being a communication.) February 21; six months.

Thomas Liddell, of Newcastle, engineer, for improvements in apparatus for preventing explosion in steam boilers. February 21; six months.

Robert Rettie, of Gourock, Scotland, civil engineer, for improvements in gridirons, frying-pans, and other cooking utensils and heating apparatus. February 24; six months.

Francis Studley, of Shrewsbury, gentleman, for an improved mill, or apparatus for grinding grain, with or without sifter or dresser, also for cobbling, bruising, crushing, cutting, splitting, or dividing seed, pulse, berry, or other articles. February 24; six months.

Alexander Alliott, of Lenton, Nottingham, bleacher, for improvements in scouring, bleaching, and dyeing. February 24; six months.

Thomas Masterman, of the Dolphin Brewery, Broad-street, Ratcliff, common brewer, for a certain method of mechanism for the speedy cooling of liquids, being within certain degrees of temperature, and which method, or mechanism, he terms a "Refrigerator." February 24; two months.

William Rouse, of Great Barton, Bury Saint Edmunds, wheelwright, for certain improvements in carriages, and in parts of carriages applicable to various purposes. February 24; six months.

Peter Rothwell Jackson, of Strawberry Hill, Manchester, engineer, for certain improvements in the construction and manufacture of wheels, cylinders, hoops, and rollers, and in the machinery or apparatus connected therewith, and also improvements in steam valves. February 24; six months.

Henry Brown, of Selkirk, for improvements in carding silk, cotton, and other fibres. February 24; six months.

Benjamin Bailey, of Leicester, framesmith, for improvements in machinery for manufacturing looped fabrics. February 24; six months.

Caleb Bedells, of the borough of Leicester, manufacturer, for improvements in the manufacture of bonnets, collars, capes, caps, shawls, coats, gaiters, scarfs, stockings, gloves and mits. February 24; six months.

Gaspare Conti, of James-street, Buckingham-gate, gent., for improvements in hydraulic machinery to be used as a motive power. February 24; six months.

John Aitken, of Surrey-square, for improvements in atmospheric railways. February 24; six months.

Archibald Trail, of Great Russell-street, Bloomsbury, for an improvement in the manufacture of sails, for ships and other vessels. February 24; six months.

James Smith, of Queen's-square, Westminster, esq., for improvements in slubbing, spinning, twisting and doubling cotton and other fibrous substances. February 24; six months.

LIST OF PATENTS GRANTED FOR SCOTLAND FROM THE 22ND OF JANUARY, TO THE 22ND OF FEBRUARY, 1844.

Thomas Aspinwall, of Bishopsgate-churchyard, London, esquire, for an improved cannon, formed either of wrought iron or steel, or wrought iron and steel combined, and also instruments and machinery used in making, and a method of making said cannon. (Being a communication from abroad.) Sealed, January 25.

Thomas Southall, of Kidderminster, Worcestershire, druggist, and Charles Crudgington, of the same place, banker, for improvements in the manufacture of iron and steel. January 25.

Alexander Spears, of Glasgow, merchant, for certain improvements on, or appertaining to glass bottles, proper for wines and other liquids. (Being a communication from abroad.) January 31.

William Edward Newton, of Chancery-lane, civil engineer, for a new or improved system of machinery, or apparatus for obtaining and applying motive power for propelling on railways or water, and for raising heavy bodies, applicable also to various other purposes, where power is required. (Being a communication from abroad.) February 5.

Philip Walther, of Angel-court, Throgmorton-street, London, merchant, for certain improvements in the construction of steam-engines. (Being a communication from abroad.) February 5.

John Kibble, of Glasgow, gentleman, for improvements in transmitting power in working machinery where endless belts, chains, or straps are, or may be used. February 12.

Hugh Inglis, of Kilmarnock, Ayr, mechanic, for improvements upon locomotive steam-engines, whereby a saving of fuel will be effected, which improvements are applicable to steam-vessels and other purposes, and to the increasing the adhesion of the wheels of railway engines, carriages, and tenders, upon the lines of rail when the same are in a moist state. February 13.

Ezra Jenks Coates, of Bread-street, Cheapside, London, merchant, for improvements in the forging of bolts, spikes, and nails. (Being a communication from abroad.) February 15.

Essence of Hops.—Professor Redtenbacher has observed, that of the constituents of the hop, the bitter substance, (lupuline,) the astringent substance, and the aromatic oil, are the only substances which enter into the composition of beer. The aqueous extract of hop, prepared by boiling, may easily be preserved, and 12 lbs. of it correspond to 1 cwt. of hops; it contains the first two constituents. The oil of hops, which, in the usual method of employing the hop, is volatilized for the greater part, may be obtained by distillation with water; 1 cwt. of hops would afford 3 ozs. If, then, in brewing, extract be employed instead of the hops, and the oil added when the beer is filled into the fermenting vats, the brewer would save all the expense of store-room for hops, avoid all the risks of the hop trade, could not easily be cheated, would be able to determine with greater certainty the quantities necessary to be added, and would require less hops from the saving effected in the quantity of oil. The expense of obtaining the extract and oil from one hundred of hops would not amount to any great deal, and by this a fourth of the hops would be saved on account of the oil; so that when the price of hops stood at 120 florins per hundred, there would be a clear saving of 25 florins on the hops alone. A butt of beer would require about 2 ozs. of extract, and 11 grains of oil.—*Polytechnic Review.*

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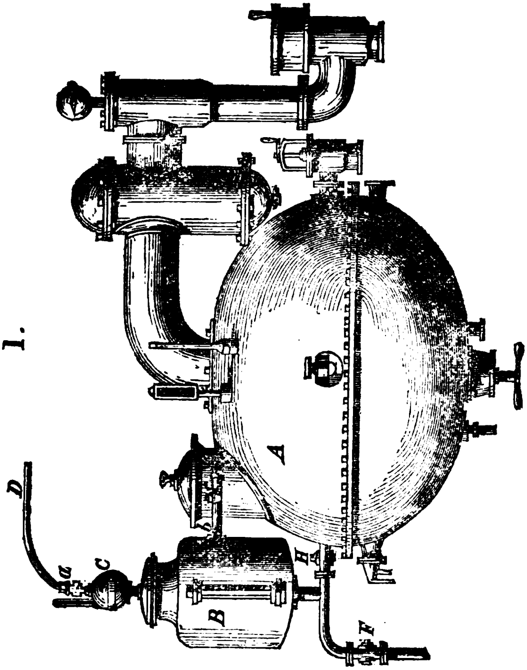
1.



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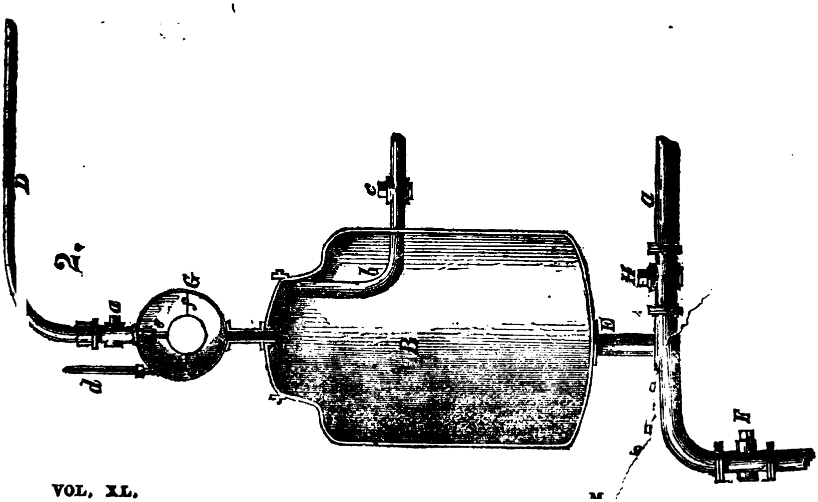


VACUUM PAN-FEED REGULATOR. JOSEPH BEAUMONT, OF 16, BATTY-STREET, COMMERCIAL-ROAD, EAST, INVENTOR AND PROPRIETOR.

[Registered under the Act for the Protection of Articles of Utility.]

Few of our readers can be unacquainted with the sugar-boiling vacuum pan, which—suggested by Davy, and patented by Howard—is generally reputed to have been the subject of one of the most lucrative patents ever granted in this country. For many years the royalties paid by refiners for licenses to use it amounted to not less than 40,000*l.* per annum. According to the old plan of boiling the saccharine syrup in open pans, it had to be subjected to a temperature as high as from 230° to 250°, which was not only injurious to the quality of the sugar, but a hindrance to the next succeeding process of granulation, for which a much lower temperature is requisite; but by the Howard method of covering in the pans, and partially exhausting them by an air-pump, the syrup being proportionally relieved from the atmospheric pressure, attains the boiling point at about 130°, or 100° less than before.

The liquor has been hitherto supplied to the pan by two different methods. One is to pump it up from the ground-floor of the sugar-house, where it is usually filtered, into a cistern on the first-floor, placed above the pans, whence it is allowed to descend by its own weight into what is called *the measure*, through a pipe, having a cock to open and shut it. This has been found objectionable for two reasons; first, on account of the double cistern room which is thus required; and secondly, because of the great agitation of the liquor from so much pumping and shifting, being materially injurious to its quality. The other method, which is that generally followed, is to cover in the measure in the same way as the pan—to connect it at the top by a pipe with the pan, so that the air-pump which exhausts the one may also exhaust the other—and to connect the measure at bottom with a pipe leading to the ground floor cistern, through which pipe the liquor rushes up into the measure, when exhausted in the manner just described, whence it is afterwards transferred to the boiling pan. But to enable the measure to empty itself into the pan, each time it is filled, it is necessary to close for the moment the pipes through which the air was exhausted from it, and the liquor admitted from below, and to open an orifice at the top of the vessel to readmit the atmospheric air, that it may, by its pressure, force the liquor out of the measure into the boiling pan; and when the measure has been emptied, the air orifice must be once more closed, and the vacuum and supply pipes again opened, before a second measure-full can be obtained, to be discharged as before. The delay which thus takes place between the different fillings, is but the least of the evils attendant on this mode of procedure; for upon each emptying of the measure, there is a quantity of atmospheric air left in it, which, on the opening of the vacuum communicating pipe, finds its way into the boiling pan, reduces the vacuum there, and proportionally impedes the boiling. It seldom takes less than from ten to fifteen minutes after the admission of the atmospheric air from the measure, before the proper vacuum in the pan, (which should never be less than 27°,) is re-established.

Worked according to either of these methods, the Howard vacuum pan is, with all its advantages, undeniably a very imperfect apparatus. That it should be capable of so much improvement, however, as is evinced in the very ingenious design represented in the prefixed engravings, is more than one could have reasonably anticipated. The inventor of it is a Mr. Joseph Beaumont, a millwright in the employment of Messrs. Bowman and Son, the eminent sugar refiners of Great Alie-street, Whitechapel, by whom it has been adopted with the most decided success, and may (we presume) be seen daily at work.

Fig. 1 is a side elevation of a vacuum pan as ordinarily constructed, with the additions thereto made by Mr. Beaumont, and which are marked C D *a d e f*. Fig. 2 is a sectional elevation on a large scale, of the parts C C *a d e f*, and of others with which they are immediately connected.

A is the vacuum pan, and B the liquor measure, both of the usual form; C is a feed regulator, which is attached to the top of the measure B, communicating with the

measure at one end and with a small steam supply pipe D at the other; *a* is a cock by which the steam can be shut off or let on at pleasure; *b* is the pipe with a cock *c*, by which a communication can also be established at pleasure between the measure B and the vacuum pan A, and *d* is a barometer inserted into the top of the feed regulator, for the purpose of indicating the pressure of the steam or vapour within the regulator and measure; E is the pipe, with a cock F, by which the liquor is admitted into the measure from below, and G H the pipe and cock by which the liquor is transferred from the measure to the pan.

On beginning to work with the apparatus, the measure B and regulator C are first exhausted, or nearly so, of the air, vapour, or gases within them, by turning the cock *c* of the pipe by which they communicate with the vacuum pan. The cock *c* is then turned off, and the cock F turned on, which allows the liquor to flow up into the measure B, to any height deemed most suitable. The cock F is then turned off, and the cock H turned on to allow the liquor to flow into the pan; and simultaneously with this operation the cock *a* is opened just long enough to admit a very small quantity of steam, which, as the measure is emptied of the liquor, expands, until ultimately the place of the discharged liquor is occupied by steam of a very attenuated quality. The measure is then filled and emptied a second time as before, and as much oftener as may be necessary during an entire day's working, without any farther exhaustion of the measure and regulator being required.

Lest, by any oversight, both the cocks *a* and F should be left open, in which case the liquor might rise into the measure and regulator, and force itself into the steam pipe D, there is a conical valve *e* a little below the cock *a*, with a spindle and ball-float *f* attached to it, by the rising of which, in any such event, the pipe D would be closed.

It is obvious that by this feed regulator all the evils attendant on the two existing methods of supply are entirely obviated. The liquor is agitated to the least possible extent in its passage to the boiling-pan; the intervals between the fillings of the measure are reduced to a minute's duration, or less; the vacuum in the pan is at no time disturbed, and the liquor is kept uninterruptedly at the boiling point. Not only is a much better article thus produced, but a great saving is effected as well in the time occupied in the refining process, and consequently in the expenditure for wages, as in the consumption of water and fuel. The saving in each of these respects is estimated by the inventor as equal to at least 35 per cent.

NEW METHOD OF CLOSING THE PNEUMATIC TUBE OF ATMOSPHERIC RAILWAYS.

[Communicated by M. Hallette to the French Academy.]

In the system adopted by Messrs. Clegg and Samuda, the tube, as every one knows, is closed by means of a long band of leather, which is free on one side, and fixed by the other to the edge of the longitudinal slit that allows the passage of the rod by which the piston is united to the first wagon of the train. Being raised for a moment to allow the passage of this rod, the band immediately falls again; a lever, the motion of which is connected with that of the piston, afterwards presses it against the opening, and an unctuous substance further contributes towards rendering the adhesion more complete.

Now independently of the unctuous body's appearing readily to undergo alteration by contact with the air, the leathern band must gradually lose its suppleness, and tend, in places, to rise a little, after the passage of the compressing lever; it is, therefore, desirable that the closing of the longitudinal fissure, instead of being due to the action of a transient effort, should result from a constant action exercised in each point of the fissure. For this purpose, M. Hallette has arranged on the upper surface of the pneumatic tube, and bodily connected with it, two longitudinal semi-cylinders, or rather two gutters placed lengthwise, with their concave parts facing. Each of these gutters contains a gullet, of elastic material, perfectly impervious both to air and to water. When the two gullets are sufficiently inflated with air, they touch each other by one part of their surface; they act as do the lips of the human mouth, and thus entirely intercept communication between the interior of the pneumatic tube and the exterior air. When the piston moves, the rod, which connects it with the train, slides between the two tubes, which unite again immediately after its passage. This rod, the horizontal section of which is a meniscus, and which hence penetrates, like a wedge, between the two gullets, acts upon them with scarcely any friction. However, in order to ensure their durability, M. Hallette has thought it advisable to protect them with leather at the parts by which they come in contact.

ON THE NUMERICAL SOLUTION OF EQUATIONS.—PART II. THE EXTRACTION OF THE SQUARE AND CUBE ROOTS.

Sir,—I purpose to show in the present paper the application of Horner's method of solving equations to the extraction of roots, as the term is usually understood. It will be seen that the process is precisely the same as that explained in the former paper, and there applied to the solution of adfected equations.

In that paper I remarked, that to apply Horner's method to the solution of *incomplete* equations, the equations must first be rendered complete, by supplying the wanting powers of the unknown quantity, with zero for their co-efficient. So, if it be proposed to find the cube root of 20 for example, the equation to be resolved is, $x^3-20=0$, which, for solution by this method, must be written, $x^3+0\,x^2+0\,x-20=0$.§ And to find the square root of 17 the equation to be resolved is, $x^2-17=0$, or $x^2+0\,x-17=0$.

Example 1. Required the cube root of 208422380089. The equation to be solved is,

$$x^3+0\,x^2+0\,x-208422380089=0\,;$$

and the operation is as follows:—

1	0	0	208422380089	5000
	5000	25000000	125000000000	900
				20
	5000	25000000	83422380089*	9
	5000	50000000	80379000000	
				5929 Root.
	10000	75000000*	3043380089†	
	5000	14310000	2095688000	
17700†	15000*	89310000	947692089‡	
20	900	15120000	947692089	
17720	15900	104430000†	0	
20	900	354400		
17740	16800	104784400		
20	900	354800		
17760‡	17700†	105139200‡		
9		159921		
17769		105299121		

The co-efficients 1, 0, 0, 2084, &c., (the last with its sign changed) being written down, it is easily found that the required root lies between 5000 and 6000. I therefore place 5000 in the root and commence the involution: 1, the first co-efficient, × 5000, gives 5000, which I add to the 2nd co-efficient, 0; 5000 times this sum give 25000000, which I add to the 3rd co-efficient; and 5000 times the last sum give 1250, &c., which I *subtract* from the last co-efficient, 2084, &c. This leaves 834, &c., which I mark with an asterisk. Commencing again with the first co-efficient, multiplying by 5000 as before, and carrying forward the sums to the next columns, we reach 750, &c. in the next to the last column, which sum is also marked with an asterisk. Again add 5000 to the first working column, and mark the sum with an asterisk. This completes the first involution. For the next part of the root, observe mentally the highest denomination of 8342, &c. divided by 750, &c. This we see is 1000; but this must be too great, because we already know that the required root is under 6000. Therefore try 900, and involve as before, using 900 as the multiplier. This brings us to the numbers marked with daggers. The division of 304, &c., by 104, &c., gives 20, which I place in the root, and use as the multiplier in the third involution. The result of this involution is, the num-

§ This need not be formally done, the only object being to ascertain the number of working columns.

bers marked with doubled daggers; and of these the division of 947, &c. by 105, &c. gives 9. I therefore place 9 in the root, and use it as the multiplier in the next involution. The first step of this involution, by reducing the last column to 0, shows that the root is attained, being $5000+900+20+9=5929$.

I have given this process at full length, that its analogy to the general process described in the former paper may be more apparent. But this application of the method admits of sundry abbreviations, by which its comparative cumbrousness is diminished, and its facility proportionally increased.

1. The writing down of so many ciphers as appear in the solution, is avoided by pointing off the number whose root is to be extracted into periods, corresponding in the number of their places with the dimension of the root. Thus, for the square root the number of places in each period will be 2; for the cube root, 3; for the 4th root, 4; and so on. A consequence of this is, that the process is assimilated to that of common division, (which indeed is nothing else than the application of Horner's method to the solution of equations of the 1st degree,) each root figure being annexed to those previously found, and employed as units in the succeeding involution. The completion of each involution is marked, in the last column, by the annexation to it of the next period; in the next to the last, by annexing to it one cipher fewer than the number of places in each period; in the second from the last, by annexing two ciphers fewer, and so on to the first working column, the annexation to which will be one cipher.

2. The first co-efficient in simple extractions being always unity, it need not be set down; and the co-efficients intermediate to this and the last being always ciphers, may also be neglected, so that the working columns will be headed by the 1st, 2nd, 3rd, &c. powers of the number first placed in the root.

3. The additions made to the first working column being always single digits, viz., the figure last placed in the root, this operation may be performed mentally, and merely the result set down.

To illustrate these remarks, I repeat the example already given, wrought as directed.

5	25	208422380089(5929 Root
10	50	125
150	7500	83422
159	1431	80379
	8931	3043380
168	1512	2095688
1770	1044300	947692089
1772	3544	947692089
	1047844	0
1774	3548	
17760	105139200	
17769	159921	
	105299121	

C[illegible]parison of this solution with the form[illegible], and attention to the precepts, will su[illegible]rsede the necessity of any explanato[illegible] remark, farther than that, as in the us[illegible]l method, the first figure to be placed in [illegible]e root, (5), is the root of the greatest cu[illegible], (125,) contained in the first period (2[illegible]). Every figure made use of is written down, and no process is omitted but such as are omitted in multiplication and division. This solution occupied less than three minutes. I imagine the usual one would require little less than an hour. As a farther illustration I give

Example 2.—Required the square root of 208422380089.

§0	208422380089(456533 Root
4	16
80	484
85	425
900	5922
906	5436
9120	48638
9125	45625
91300	301300
91303	273909
913060	2739189
913063	2739189
	0

The similarity of this to the usual process, will appear upon comparison. The time occupied by this operation was also about three minutes. The same extraction, by the ordinary method, would require probably a quarter of an hour. It thus appears that, although the advantage arising from the application of Horner's method to the extraction of the square root is considerable, it is yet very much less than that which arises from its application to the extraction of the cube and higher roots. But the cause is, that the higher we ascend in the scale of roots, the more urgent becomes the necessity for simplification. The usual process for the extraction of the square root is comparatively simple, and therefore admits of little improvement, while those for the extraction of the higher roots are so intolerably laborious and complex, that rules for none higher than the cube have, I believe, ever been given; and it is here, accordingly, that the advantage of Mr. Horner's simple and symmetrical method is chiefly apparent.|| For it must be borne in mind, that although I have, in this paper, given an example of the extraction of no root higher than the cube, the method is absolutely general. It may be applied to the extraction of a root of any dimension whatsoever, the only difference as regards the working, that arises from an increase in the dimension of the root to be extracted being a corresponding increase in the number of working columns, and consequently in the number of operations constituting each involution. The operations themselves are precisely the same. They consist, in every case, of the multiplication, by the figure last placed in the root, of the number at the bottom of each column, and the carrying forward of the product for addition to the next column, or, in the case of the last column, for subtraction from it. The first figure of the root is always the root of the highest power of the same order contained in the first period, and the succeeding figures are found by a trial division of the number at the bottom of the last column, by that at the bottom of the column immediately preceding it.

I intended to have given in the present paper, some examples of approximation to irrational roots, as for instance, to the square and cube roots of 2, since in such operations the power of this method is displayed in an especial manner. But I forbear for the present, and, if you will allow me, Mr. Editor, I will trespass again upon your space for this purpose.

I am, Sir, yours respectfully,

G.

Hermes-street, Pentonville, February 26, 1844.

Erratum in Part I. The sign — (*minus*) should be prefixed to the two numbers 298, &c., in the last column of the example on p. 150.

§ The cypher is used at the top of this column to bring the corresponding numbers in the two columns opposite to each other.

|| The time requisite for the extraction of a root of any number by this method appears to increase very slowly as the dimension of the root to be extracted increases. The number 208422, &c., being both a square and a cube is also a perfect sixth power; and I have found that the extraction of its sixth root (77) may be very easily effected in four minutes and a half. The time would have been a little more had I not known the leading figure, 7.

ROWLEY'S ROTARY ENGINE.

Sir,—Public attention having of late been specially directed to rotary engines, in consequence of the determination of the Admiralty to try those of Lord Dundonald in the *Janus*, and as their working and durability are not so much a question, as their economy in respect of consumption of fuel, I forward for your disposal, deeming it might be interesting to your readers, the following comparative consumption of the rotary engine patented by me, a description of which you gave in your valuable journal, August 27, 1842, and Messrs. Fairbairn and Co.'s improved condensing ones on "the Cornish principle." The steam was admitted at upwards of 30 lbs. pressure, cut off at certain length of stroke, and condensed. The statement has been kindly furnished by Messrs. R. Johnson and Brother, wire-drawers, 27, Dale-street, who within the last year have had those of Messrs. F. erected; they are called two 20 horses, are supplied with steam from the same boiler as the rotary, and doing similar work.

Coal consumed per Month.

Fairbairn and Co.'s			Rotary and Old High-Pressure Engines.	
1843.			1842.	
April	640	cwt.	1085	cwt.
May } June }	1147¼	,,	992½ / 1116¼	,,
July	645¼	,,	1027	,,
August	630½	,,	919	,,

Work done.

Fairbairn and Co.'s	Rotary and Old Engines.
Six wire blocks.	Six wire blocks.
1 from 0 to 6	1 from 0 to 3
3 ,, 3 to 6	2 ,, 3 to 6
2 ,, 6 to 9	1 ,, 6 to 9
4 scouring barrels.	2 ,, 9 to 12
Kent & Co.'s Tenants.	Kent & Co.'s Tenants.

The old high-pressure engines were solely employed in driving the *works of the Tenants*, smallware manufacturers, said to take *four* horses power, and the rotary in driving the wire, or as they are usually termed "Ripping-blocks." I give the engines of Messrs. Fairbairn and Co. credit for six additional horses power, which is ample for driving the scouring barrels and the larger size of some of the blocks. Estimating them therefore at 40 horses, they are only taking about 6 lbs. of coal per horse per hour, assuredly a low figure. This being granted, I am warranted in stating the power of the rotary and old engines at 34 horses, and their consumption of coal at 11 lbs. per horse per hour, which it must be conceded *is very economical.*

The conclusion I arrive at is, that if rotary engines were worked on Wolf's principle, viz., high pressure in one cylinder engine, the steam from which is admitted into a second cylinder and condensed, that they would be found fully equal to the most improved reciprocating ones. The question then arises, what advantages do they possess beyond regularity of action? Simply these: they will cost a third less—weigh a third less—and occupy a tithe only of the room of reciprocating ones. One would suppose these to be no mean recommendations for marine purposes. I am, &c.

EDWARD BUTLER ROWLEY.

METHODISED STREET NAMES.

Sir,—It has often occurred to me that by a very simple methodical system, our reets might be so named, that strangers, r even foreigners might find any particu- ır street leading out of a great thorough- ıre, with as much ease as the particular ouse of which they may be in search. 'he latter is of course readily found by s number (or ought to be), but the ıming of our high ways and bye-ways most arbitrary. Some system is highly sirable, particularly in an overgrown ace like the metropolis. The Metropolitan Improvement Society has pointed out the confusion arising from our many King, Queen, John streets, &c. But no plan, I believe, has ever yet been proposed for facilitating the finding of any off-street in such thoroughfares; for example, as the Strand, Regent-street, Oxford-street, Holborn, and similar lengthy roads.

I am aware of the inconvenience of changing names, and that seems to be the only drawback to my plan. As, however, it may be considered to possess

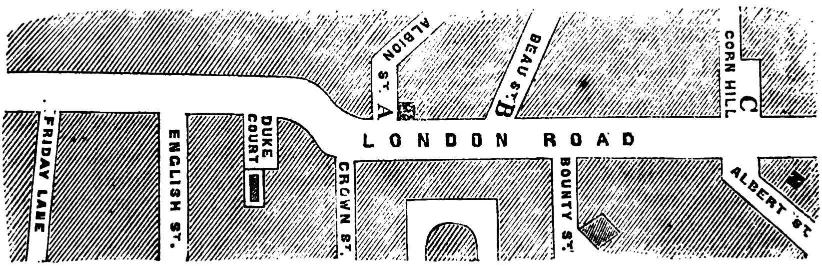
some novelty, I shall explain the method I would propose, and which I would specially recommend for all new-laid streets at the outskirts of London and elsewhere.

In public ways of from one-half to two miles in length, there must necessarily be a great number of streets leading into them from the right and left. My proposal does not affect the name of the main road, let its name be what it may. I would suggest the propriety of naming the first street leading off from the right A, the next B, and so on,—choosing a word for each, beginning with these letters. If at the 25th or 26th letter, that side was not completed, the alphabet might be recommenced. Suppose the right-hand side ended with R, on taking the left-hand side, the opposite street might have a name commencing with S; or, it might be better to commence afresh with A; thus, we should commence, we may suppose, at the right-hand at A, reach the top of the street, find the last off-street named with R, cross over, find a street beginning with A, the next B, and so on until we returned to the point from which we had started.

To avoid being misunderstood, I give the following sketch of my proposed plan, where each side of the street commences afresh with the alphabet, and I am, Sir, your obedient servant,

H. D.

Surrey, February 26, 1844.



PREVENTION OF PRIMING AND INCRUSTATION.

Sir,—If you should consider the following communications worthy of a place in your useful Magazine, you may, by their insertion, render a service to proprietors of steam-engines, and oblige your very humble servant,

WILLIAM HALL.

Lyons, February 12, 1844.

1. *Prevention of priming.*

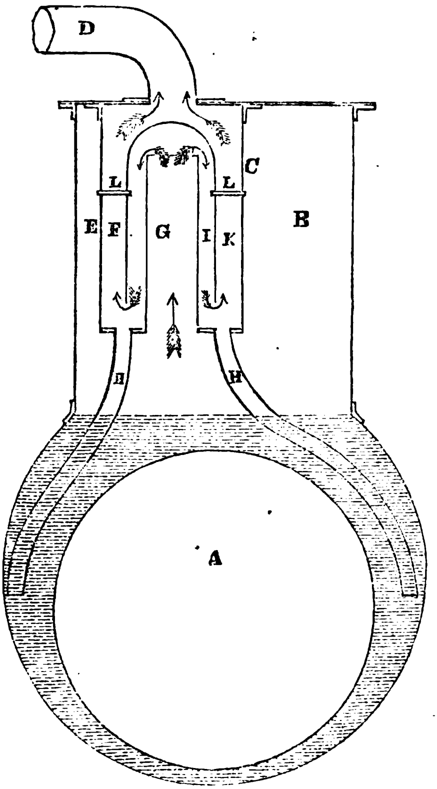
The first is an apparatus to hinder the water of steam boilers from being thrown into the cylinders of steam engines by what is commonly called "priming," which is the cause of many evils, such as loss of power, waste of coal, rapid wear of slide facings, pistons and cylinders, and in marine engines (notwithstanding the precaution of putting safety valves both at top and bottom of the cylinder) the rupture of beams, cross bars, side rods, &c.

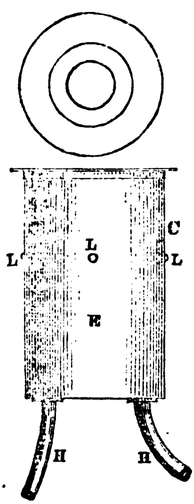
The apparatus, which I will call a "Separator," is very simple, and may be understood by the accompanying sketches. Fig. 1 is a sectional view of a boiler and steam chamber fitted with a separator. Fig. 2 is a view of the exterior of the separator. A is the boiler; B, the steam chamber; C, the separator; D, the steam pipe to the engine; E, the external envelope of separator, bolted to the cover of steam chamber; F, middle cylinder, with a concave end fastened to E by small stay bolts, L; G, steam pipe passing through the bottom of E, and rising into the inverted cylinder F, till within three inches of touching the concave bottom; H H, pipes fastened to the bottom of the cylinder E, about 2 inches in diameter, and descending into the water of the boiler on each side of the flue; I, the annular space formed by the pipe G, and the inverted cylinder F; K, the annular space formed by the inverted cylinder F, and the outside cylinder E, leading to the steam pipe D.

The dimensions of a separator, as applied to the steam boiler of an engine 20 horses power, is as follows:—Outside cylinder, E, 30 inches in length, diameter 18½ inches; inside cylinder, F,

11¼ inches diameter, 23 inches long; steam pipe, G, 5½ inches diameter, and 23 inches long. The inverted cylinder F reaches to within 3 inches of the bottom of E, and there are two pipes, H, of 2 inches diameter, each dipping into the water of the boiler, one on each side of the flue, and opening into the cylinder E.

The action of the separator may be thus explained. Supposing the pipe G to be 23 square inches in area, and the descending annular space to be 72 square inches area, and the ascending annular space, K, to be 159 square inches, in round numbers; then the velocity of the steam will be inversely as the numbers 23, 72, and 159, in each of the spaces; and as the velocity of the steam and water decreases, the water will be acted on by the force of gravity, and fall to the bottom of the cylinder E, and return to the bottom of the boiler by the pipes H H.





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Care must be taken to make the pipe G somewhat larger in diameter than the steam pipe D, so that the pressure in the separator may be at all times equal to the pressure in the boiler; otherwise the water would not fall by the pipes H H freely. The pipes H H ought to be sufficiently large to convey the separated water easily back to the boiler.

I first applied this method in 1834, and when the separators had been in use about eighteen months, the water began to be thrown into the cylinder at intervals when the steam was very strong, at the same time giving a sensible shock to the steam pipes. On the separator being examined, the pipes H H were found almost choked with lime, or what is com-

monly called "fur." I had them cleaned out, and they acted as at first.

I have applied the separator to many boilers, and they never have failed to do away with "priming." I make them of thin sheet iron, and the pipes H of copper.

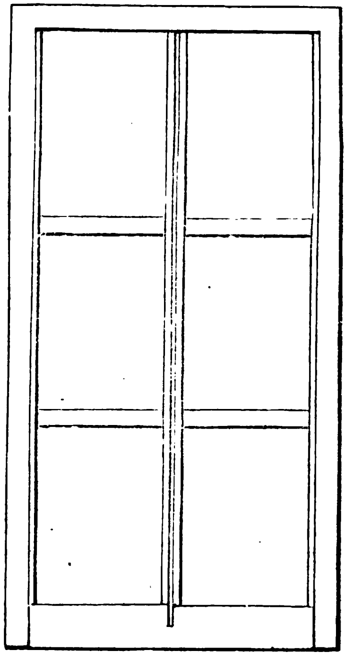
II. *Prevention of Incrustation.*

The next invention is a method of hindering incrustation on boilers, which is a very bad conductor of heat (whatever Mr. C. W. Williams may say to the contrary in your 966th Number, page 118) and causes great waste of fuel. This I accomplish by putting a quantity of common salt into the boiler at regular intervals, which not only keeps the boiler clean, but causes the incrustation already formed to fall off. I consider it, however, unsafe to put salt into a boiler much "furred," especially a land engine boiler, when the fire acts directly on the bottom, as the slabs of lime falling on the plates above the fire might cause them to be injured, by keeping the water from the plates. The best method, therefore, is to clean out the boiler as well as possible before using the salt, and then putting the salt in regularly, which might be done once each week by dissolving it in hot water, and pouring it in by a convenient cock. Land engine boilers, fed from springs or filtered water, might be left unopened for twelve months, or even longer, if care be taken to supply them with salt (a little too much will do no harm), and the boilers filled with water above the ordinary level, before the engine is stopped for the night, and the surplus blown off; this may be done about twice a week.

Steam-engine proprietors will find a great saving in pursuing this method, both in boilers and fuel. The quantity I put into a pair of boilers of 40 horses power is about 8 lbs. every 8 days, when the river is low, and less when the river is swelled with rain, as then the water contains proportionally less lime. The chemical action of the salt on the lime is simply as follows:—the salt (muriate of soda) mixes with the water, forming a new combination with the lime, either in the state of a carbonate or a sulphate, forming in the first case muriate of lime and carbonate of soda, and in the second muriate of lime and sulphate of soda, all soluble salts, which do not injure the plates. I have employed this method during five years, and had agents appointed in this country. But they did not all deal justly towards me, which decided me to make it public. It was used in Glasgow in 1842, by a gentleman to whom I gave leave to put it in practice.

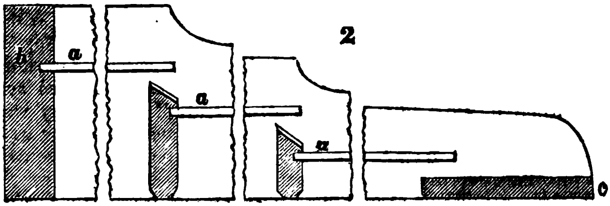
WILLIAM HALL.

IMPROVED SKYLIGHT.



Sir,—From the repeated complaints which I have heard against the common skylight so frequently drawing water, I have been induced to turn my attention to the subject, and herewith send you a sketch of one which I invented some time ago, and which I think fully answers the desired object. Within the last eighteen months I have introduced them in roofs, some of which are in very stormy situations, and with the most perfect success; none of them, so far as I have been able to discover, having drawn the least water. Another advantage which this skylight possesses, is that the glass cannot break

2



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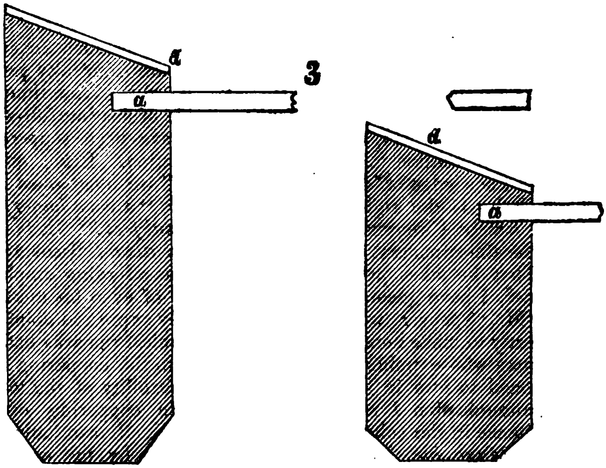

in frosty weather from the water standing in the laps, and further, that the condensed water can so easily make its escape instead of falling inwards, both of which are very serious defects of the skylights in common use. Should you think the improvement worth notice, you will oblige me by presenting it to your readers. I am, Sir, yours respectfully,

H. RISHTON.

Kendal, February 20, 1844.

Description of Engravings.

Fig. 1 is an elevation of the improved skylight.

Fig. 2 is a longitudinal section; *a a* are the squares of glass; *b* the top rail; *c* the bottom of rail.

Fig. 3 is a section of the cross bars of the full size; the top edges, *d d*, are covered with thin sheet copper to preserve them from decay.

THE INVENTION OF ELECTROGRAPHY AND MR. SPENCER.

Sir,—I am sorry that Mr. Spencer should require me again to trouble you, before clearing himself of the charges brought against him. His patience, under any other circumstances, would be highly commendable, but in the present instance, while taunting others with "slipperiness," he, at least, should have avoided what he so properly condemns. I can, however, well understand, that in the unenviable position in which he must find himself placed, he will, by the judicious portion of his friends, whose counsel he follows, be recommended to adopt the tortuous course of special pleading, of which he has given us an example in his wordy letter of the 27th ultimo. All this wily artifice aids in gaining time, besides the chance it offers of thereby entrapping an opponent. A dubious kind of credit is, therefore, due to Mr. Spencer's friendly counsellors in a case requiring on his part the utmost caution, so that by following the course adopted, he at least

acts prudently. Still it would be advisable for him to consult further as to the propriety of continuing this course of Chancery practice, especially as the veritable *discoverer of electrography* is himself prepared to step forward to vindicate his rights. I grant Mr. Spencer must have been in a state of trying uncertainty as to this fact, for it would assuredly have made somewhat in his favour had his rival either been in a foreign land, or still further removed to "that bourne from which no traveller returns."

Mr. C. J. Jordan has hitherto been an entire stranger to me; it was only last Wednesday, the 28th ultimo, that I had the pleasure of a first interview with him. I find he was born in London, and is by profession a printer. He is a young man of very unassuming manners, possessing much ingenious inventive talent, as well as a thorough knowledge of electrography, of which he is the rightful originator, and of which I venture to predict he will yet be the ornament and great improver. That he takes precedence of Mr. Spencer, I have incontrovertibly proved; Mr. Spencer would therefore only act justly to make honourable mention of a man whose published labours were mentioned to him in 1839 by myself, in a communication I made to him of their existence in the columns of the *Mechanics' Magazine*, but of which he then made no account; yet of Mr. Jordan's labours (as I have shown) he has amply availed himself, though his very *name* he has, to the present moment, pertinaciously persevered in suppressing,—a degree of caution singularly significant of the weakness of his cause.

Mr. Spencer finds, in my last paper, two "simple falsehoods," as he unceremoniously terms them; and the naming of these, he seems to think, at once invalidates my whole evidence. Of the first, I beg to say I am sorry I should have placed over-much reliance on my authority, having ventured the statement on an assurance made to me in a very positive manner by Mr. Spencer *himself*, that he had transmitted to the Admiralty *a model vessel, coppered by the electrotype process*. Mr. Spencer here, with admirable *naïveté*, presents in himself an amusing instance of a person of limited information swelling into all the importance of a very oracle, when he dogmatically says, "I have long since put amateur shipbuilders in the way of covering the bottoms of their toy vessels with copper; but at a meeting of the Polytechnic Society I devoted part of an evening to show the *utter absurdity of such schemes on a large scale*." And very wroth is he with my statement, assuring us that "the avowed intention is, to convey that I must have possessed but a very imperfect knowledge of the subject when I was capable of entertaining an idea *so absurd*. So, indeed, I confess I would!" For Mr. Spencer's information, it is a fact, in spite of that other fact that HE had "devoted part of an evening to show the utter *absurdity* of such schemes," that the Lords of the Admiralty actually have had constructed for some time past large tanks, capable of floating full-sized boats, and which have been coppered therein by voltaic action. Ergo, on his own "confession," we must allow Mr. Spencer to possess "*a very imperfect knowledge of the subject!*" It is lamentable to see the *soi-disant* discoverer of electrography thus affording ample evidence of the fallacy of even his most confident and arrogantly expressed opinions. The gist of my ironical remarks had reference not so much to the coppering of vessels, as to the probability of the idea springing from the coppering of "tubs!" Of the second, I can only say, that having prefaced by the words, "*I am informed*," the statement as to his patent being a matter of legal contest against him, it is evident from this that I did not give it on my own authority, and that I, at least, am not chargeable with wilful misrepresentation. Mr. Spencer must surely be aware that all this stickling at trifles looks very suspicious, particularly while he leaves the main charge unattacked.

I have to thank Mr. Spencer for the opportunity now afforded me of rectifying an error committed in my last paper, which, as it flattered his vanity, I suppose might otherwise have passed unnoticed. I have since found that others have committed the very mistake I wish to correct. In my enumeration of his *improvements*, I name his "using an etching ground to attach raised lines to the copper through the etched lines, (the present beautiful process of glyphography.)" The glyphographic process is the reverse of this, being one by which an entire electrotype plate is produced, the varnished and etched copper-plate

being merely employed to serve as a kind of mould.

In the Glasgow *Practical Mechanics' Magazine* for February 17, appears an article on electro-metallurgy, in which the writer says, "We may mention here, that during the same time that Spencer was maturing *his discovery*, so as to bring it before the public, Professor Jacobi, of St. Petersburg, announced a similar discovery, and, as in many other instances, the merit of the *first discovery* of this art has consequently become a matter of dispute, both claiming precedence. From the evidence brought forward on the different sides, it would be *a matter of some difficulty to decide to whom it most justly belongs*," p. 164. It is thus, as I hint in my last paper, that the prevailing misconception respecting Mr. Spencer's pretensions runs through every scientific work on the subject at home, and which, unless corrected, we need not be surprised at the error being perpetuated abroad.

Mr. Spencer, as if nothing would serve but making him "bare as the palm of the hand," pretends to suppose I have not yet completed my charges against him, merely because in my second paper I endeavour to strengthen what I had advanced against him in my first paper, in consequence of his jeeringly designating my remarks as "this little attack of Mr. Dircks's." In my first paper I asserted his plagiarisms; in my second I prove their existence. Having intimated his want of originality, I prove in my second contribution, by five examples, that we have abundant evidence of his building his fame on the merit due to others. He may be right in supposing the subject not exhausted; no doubt a reference to the French and German scientific journals, with which he has of late made himself acquainted, would lead to the true source of many of *his* discoveries (?) for perhaps he is the greatest *discoverer* of modern times. But I can assure Mr. Spencer that I have no ambition to scrutinize the amount of originality belonging to his other papers, not even his last elegant production on *clairvoyance*,* (detailing Mrs. Todd's powers of second sight,) particularly after the specimen of gross plagiarisms already so clearly made out, in respect to his paper of September 12, 1839, and which he so evidently shrinks from refuting.

Mr. Spencer sadly misunderstands me in my concluding remarks, in supposing I intend publishing a pamphlet on the present, to him, all-important discussion. All I meant to convey was, that in any future notice of the history of electrography, in a premeditated electrical treatise, I should acknowledge only Mr. Jordan as the discoverer, and *not* Mr. Spencer, as has hitherto most mistakenly and unjustly, though I am sure very unknowingly, been done by every preceding writer. And Mr. Spencer, much as he plumes himself on a happier fate, will nevertheless find that his sun has set, and that whatever of honour can attach to being the inventor of the electrographic process, will hereafter be unhesitatingly

* In his late letters Mr. Spencer places together two very incongruous remarks—1st, That he will have *little* difficulty in overturning my statements, and yet, 2nd, That his having his *hands full*, he claims a few weeks' respite. The *Liverpool Journal* of March 2, throws some light on what has so much absorbed his valuable hours. No less than four columns of the journal are occupied with a verbatim report of Mr. Spencer's paper "*On some Recent Instances of Clairvoyance*," read at the Royal Institution, Liverpool, before the Literary and Philosophical Society on the 19th of February. All the instances given refer to Mrs. Isabella Todd, a Scotchwoman, and is a clever puff of Mr. Spencer's shop and laboratory, of which she gives a very fair inventory, even to his very "papers full of scribbles," to use her own significant term. The intellectual treat afforded by this good woman's conversations might well satisfy him to lie awhile in the dust. Take one example, which shall suffice, though there is abundance of the same edifying dialogue—"I then asked what was on the walls." "Two shelves." "What is on them?" "Dishes." "What is on the floor?" "Some dishes." "What is on the table you spoke of?" "Papers full of scribbles." Mr. Spencer's own share in the business was such as might well make his "hands full," and the Liverpool Phreno-Mesmeric Society are fortunate in having such an advocate as Mr. Spencer, over all whose performances there presides the semblance of an imposing genius. One illustrative example of Mr. Spencer's experiments must close this note. "After being in the adjoining room (he says, Mrs. Todd being in the clairvoyant state in another apartment) some minutes, perfectly still, I put my thumb to the tip of the nose, and extended the fingers outwards, in the most approved manner, and as we frequently see enacted by the clown in the ring. I remained in this dignified attitude for some time. I then returned to the other apartment, and requested to know what I had been doing, the parties present having been instructed to question her during my absence. I was answered by some tittering, but Mr. Todd said that she was no doubt exhausted by the length of the experiments, and they could not get her to answer what I had been doing." The whole of this verbose paper is nothing more than a tedious enumeration of vulgar commonplace experiments, which are made the medium for conveying, first, to a learned scientific body, and afterwards to the public, the highest order of phenomena affecting the animal economy; for he most unsatisfactorily winds up by confessing, "I have no theory to offer."

awarded to Mr. Jordan. *Palmam qui meruit ferat.* I remain, Sir,

Your obedient servant,

HENRY DIRCKS.

77, King William-st., City, March 4, 1844.

P.S. In connexion with the subject of the discovery of electrography, I think the following extract will prove interesting, from a paper "On the Effects of a Battery charged with Sulphate of Copper," by Warren De la Rue, in the *London and Edinburgh Philosophical Magazine* for 1836. He says—

"The zink plate is always partially covered with a coating of copper, which, however, is not detrimental to the power of the battery; the copper-plate is also covered with a coating of metallic copper, which is continually being deposited; *and so perfect is the sheet of copper thus formed, that, on being stripped off, it has the polish, and even a counterpart of every scratch, of the plate on which it is deposited.*"

Mr. De la Rue makes this remark incidentally, and I only offer it here as a proof how near others have trenched on the discovery of a useful application to the arts of that very deposited copper, which was a result unfavourable to the action of the battery. Mr. Jordan was the first to direct attention to a useful and ornamental adaptation of this property, peculiar to the action of sustaining batteries, literally bringing good out of evil—for it was before always a desideratum to get rid of this *detrimental* deposit. H. D.

[We cannot blame Mr. Dircks for not subscribing to the terms which Mr. Spencer wishes to have conceded to him before entering on his vindication from the charge of misappropriation which has been brought against him. Mr. Spencer is in no condition to stipulate terms. The charge has been made, and it is for him to answer it, or not, as he pleases—it is his own affair. If he do not, the public will know what conclusion to draw. We fear that, as it is, any denial he may now make will come all too late to prevent impressions very much to his prejudice. It was an easy thing to say, "When I claimed the English invention of electrography, I knew nothing of Mr. Jordan's letter; I had never seen it, never read it, never heard of it;" and if he could say so truly and sincerely, we cannot understand why he should have deferred doing so for a single instant. Mr. Spencer has written two pretty long letters to us on the subject since the charge was brought against him, but we have looked in them in vain (much to our regret) for any such distinct disavowal as this. People do not ordinarily take time to consider whether they have been guilty of such offences as that imputed in the present case. It would not have taken Mr. Spencer a hundredth part of the pains to say the few words we have suggested, which he has taken to evade, or at least postpone the saying of them.—ED. M.M.]

WYLAM'S PATENT FUEL.

[English Patent dated, June 22, 1843; Specification enrolled, December 22, 1843.]

Notwithstanding the great number of patents which have been taken out for artificial fuels during the last ten years, it is certain that down to the close of the past year a good and efficient substitute for natural coal still remained a desideratum. Grant's fuel, which the Government took at one time under its special patronage, has not been found to answer the expectations formed of it, and is no longer supplied to the Royal Navy steamers. Of Cooke's fuel, which was tried at the Polytechnic Institution last spring, and gave such promising results, (See *Mechanics' Magazine*, No. 1052, p. 270) we have heard nothing further, and presume that that also has proved in some respect or other a failure. The fuel which we have now to bring under the notice of our readers, would appear, according to all accounts, to be in good truth the very thing so long desired. Mr. Sopwith, one of our most eminent geologists, who has been lecturing upon it at Newcastle-on-Tyne, speaks of it with an enthusiasm which geologists alone perhaps can feel on such a subject; but which is not without ample warranty in the following remarkable facts, which have been established by a long and rigorous series of experiments.

First, the Wylam fuel exceeds the best natural coal in heating power by about 25 per cent., while, weight for weight, it does not occupy more than half the space. A ton of natural coal occupies on the average 45 cubic feet, but the same weight of the new coal occupies only 30; presenting an advantage in point of stowage of 50 per cent. This difference in bulk is fully accounted for by the very small quantity of residual matter furnished by the combustion of the new coal; it amounts to but 1 pound in 280. The natural coal has mixed up with it a large portion of extraneous substances, which contribute nothing to the heat evolved; while the artificial is

made up almost entirely of purely combustible ingredients.

Secondly, it burns with abundance of flame (which no other artificial fuel we know of does), and the smoke it emits is not only much lighter than usual, but wholly free from offensive odours.

And thirdly, it is of so homogeneous, compact, and hard a quality, as not only to resist breakage in the course of stowage, but to burn to the last without running. We believe that as much cannot be said of any other artificial fuel. We have seen some sorts which were no sooner ignited than a process of fusion commenced, which speedily resolved the whole into one intractable mass; and Grant's fuel has been known to run, under no greater heat than that to which it has been subjected in the bunkers of an engine room.

It is impossible to rate too highly the importance of a species of fuel possessing such properties as these to the interests of steam navigation. It may be said, indeed, to multiply at once by three-fourths the effective force of this arm of the public service. A vessel now capable of stowing but 600 tons of fuel, may now stow 900 tons, and of such a quality as to have 25 per cent. greater heatign power, which is equal to an increase of 75 per cent. on the vessel's steaming capabilities. Instead of voyages of 2000 and 3000 miles, we may now hope to see shortly voyages of 4000 and 5000 performed with equal facility and certainty.

The composition of the fuel, and the mode of manufacturing it, are thus described in Mr. Wylam's specification:—

"I first make an artificial composition (which is used afterwards as a flux for the formation of the coal) either from small coal, or coal dust, and tar or pitch, or from peat or turf, and tar or pitch in manner following.

"When made from small coal or coal dust and tar, or pitch, I mix together equal parts of these materials (preferring that sort of tar which is to be obtained from gas works, and is produced by the distillation of coal,) and subject the mixture to a very strong heat till th particles of coal have the appearance of be ng completely fused and amalgamated wi h the tar or pitch, (which is generally in th space of about an hour). I then pour out th mixture on some cold surface which has be n previously powdered over with coal dust to prevent adhesion, and allow it to cool; wl n cold it becomes quite hard and solid, a is of a perfectly uniform texture. I then g nd it into powder for subsequent use.

"When the artificial composition is made from peat, or turf, and tar or pitch, I proceed as follows: I take 50 parts of peat or turf in the state in which it ordinarily comes from the field, and free it from the greater portion of the moisture which it contains, either by pressure or evaporation. I add to it an equal weight of tar or pitch (preferring coal-gas tar as aforesaid,) and mix the two materials together; I then leave them in this state for two or three hours, after which I place them in a cauldron, or other suitable vessel, where they are subjected to a boiling heat for about three hours. The peat or turf has at the end of that time all the appearance of being completely dissolved in the tar or pitch. The mixture is then cooled in the same way as the coal-tar mixture first before described, and when hardened, it is also ground to powder and used in that state.

"The mode of applying the said artificial composition to the preparation of fuel varies with the nature of the substances from which the fuel is made. To manufacture a fuel from small coal or coal dust, or in other words, to convert small coal, or coal-dust, into large coal, I lay from 85 to 92 parts thereof upon a hot plate, or put them into a cauldron, or other vessel, and subject them to a strong heat, and add thereto, from time to time, from eight to fifteen parts of the artificial composition of either of the varieties aforesaid, stirring the materials well together until a complete amalgamation of them appears to take place (which is generally in about a quarter of an hour). The product of this operation is a plastic substance of about the consistency of clay. While it is yet in a hot state it is put into moulds, and as each mould is filled, it is subjected to strong pressure, either from the ram of a hydraulic press, or from the fall of a tilt hammer upon it, or by any other suitable mechanical means. The moulds are then set aside to cool, and when cooled, they are opened and the blocks of coal removed. In point of cohesiveness, solidity, and uniformity of texture, these blocks are equal to any coal of natural formation. They possess also great heating power, do not run or fall asunder at very high degrees of heat, do not deteriorate from exposure to the action of the atmosphere or of moisture, and leave an exceedingly small portion of ashes, generally quite free from clinkers. When the small coal or coal dust is of a highly bituminous quality, I mix therewith a portion of dry turf or peat, broken into small pieces, or reduced to powder.

"To prepare with the help of the said artificial composition, a rich coal from a poor coal, I add to any given portion of the small or dust of the poor coal, which is required to be made rich, from 10 to 15 per cent. of

either of the varieties of the said artificial composition, according to the degree in which the coal requires to be enriched. I then subject the mixture to exactly the same processes of heating, moulding, pressing and cooling, as hereinbefore directed to be followed, for the purpose of converting small into large coal.

"To prepare with the help of the said artificial composition, a fuel from dry peat or turf, or the refuse of tan pits, or any other vegetable substance possessing like combustible properties—I take 60 parts of peat or turf, or tan-pit refuse, or like combustible vegetable substance, and reduce it to powder. I then add 25 parts of small coal or coal dust, and 15 parts in the state of powder of the artificial composition of either of the varieties before described, but preferring that made from coal and tar. I mix the whole well together, and pass them through the same processes as is before directed to be followed for the conversion of small into large coal, and poor coal into rich. The product is a fuel similar in appearance to coal, and which, weight for weight, will evaporate as much water as some of the best sorts of small coal."

It is proper to state that, though the patent for this fuel is in the name of Mr. Wylam, he claims the invention only as "the communication of a foreigner residing abroad." The foreigner referred to is Mr. Marchal, of Brussels, C.E., with whose abilities as a railway improver our readers are already familiar. It is only fair at the same time to add, what we know to be the fact, that but for the extreme pains which Mr. Wylam and his partners (Messrs. Bertram and Parkinson) of the Tyne Coal Company, have taken to test the value of Mr. Marchal's invention in every possible way, previously to bringing it before the public—but for the great judgment and skill with which they have worked out the various practical details, on the right arrangement of which success in such matters so much depends—and but for the liberal expenditure of many thousand of pounds on these experimental proceedings, it would most probably never have attained to the degree of perfection which it now happily exhibits.

SHUTTING CAST-STEEL.

Sir,—In answer to the enquiry at p. 359, No. 1029, for the best method of shutting cast-steel, I beg to send you the following particulars.

A composition for welding cast-steel to iron may be made of two-pennyworth of borax, and the same quantity of spirits of sal-ammoniac. Put the borax in a small crucible, and place it snugly in a forge fire, keeping the crucible covered to prevent the blacks from falling in. When the borax is melted, pour in half the quantity of spirit; cover it again for a short time, say half-a-minute; then pour in the remaining spirit, place the cover on as before, and about the same time. Next lift out the crucible with pliers, and empty the contents on an iron plate. In cooling, the mixture cracks, and if not confined with a broad nave hoop, or something similar, a portion will be lost; crush it fine before using. The crucible should be inverted directly after using, put on a piece of dry or hot tile, and after sprinkling some hot ashes over it, left to cool.

Neither the iron nor the steel requires to be welded hot. I have always found it best to place iron and steel together for the first heat, and when brought out the steel must be lifted, and the composition put on the iron only, the steel replaced, and then put in the fire. A small hollow fire is best, or, as the smiths term it, *with a bit of crust over the top*. I am, Sir, Yours, &c., VULCAN.

January 31, 1844.

Sir,—Having lately assisted a miller in my neighbourhood in a similar case to that complained of by your Isle of Wight correspondent, at p. 359 of the last volume of your interesting Magazine, I take the liberty of forwarding my plan of rendering worn-out mill-bills efficient for future purposes, hoping that it may not yet be too late to prove acceptable to your enquirer. I am not aware of any method of welding them together, but the plan I recommend, and which is quite effectual, is the following:—Take any two of the worn-out bills, whose weight together is considered sufficient for a new one, and let each be hammered into the shape I have endeavoured to represent in the first of the subjoined figures. When this

is accomplished, let the two bills be placed together, thus:—

and connected by two strong iron rivets *r r*. The rivets should be countersunk, and driven in hot. I have no hesitation in saying your correspondent will find this plan answer his purpose. I am, Sir,

Yours respectfully,

AN AMATEUR.

Marsham, Norfolk, Feb. 8, 1844.

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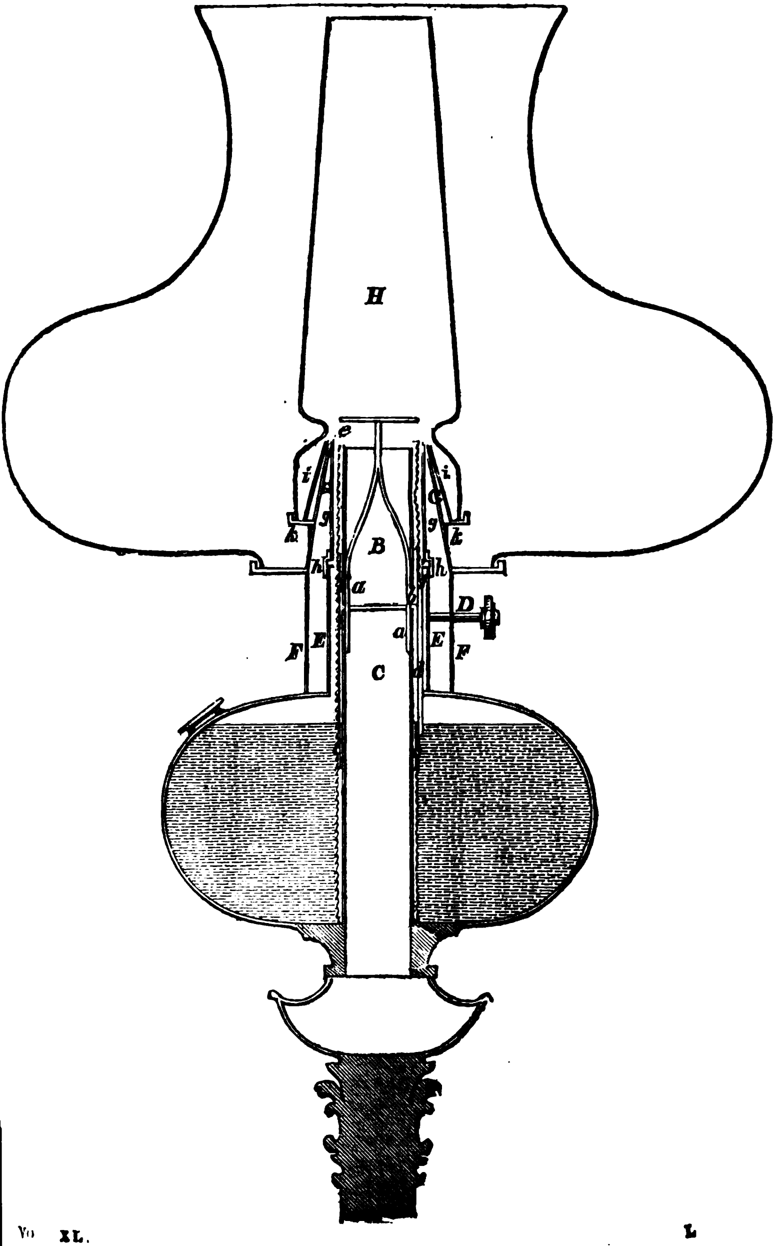
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1075.] SATURDAY, MARCH 16, 1844. [Price 3*d*.

Edited by J. C. Robertson, No. 166, Fleet-street.

SMITH'S VICTORIA CAMPHINE LAMP.



THE VICTORIA CAMPHINE LAMP. CHARLES FOX SMITH, OF 281, STRAND, AND HATCHAM, SURREY, OIL-MERCHANT, PROPRIETOR.

[Registered under the Act for the Protection of Articles of Utility.]

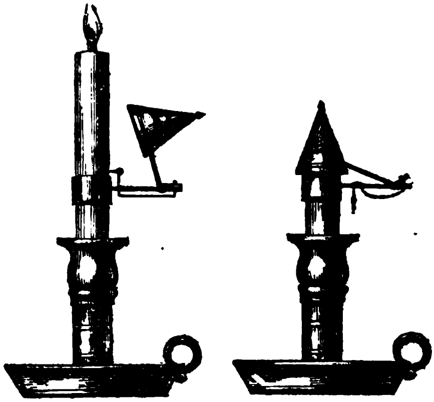
CAMPHINE is the name of the popular light of the present season, and a very clear and beautiful light it is. In the thing itself, however, there is nothing new, for it is simply rectified spirits of naphtha, tar, or turpentine, and the patent for it (granted to Mr. Wm. Oxley English, of Hull, December, 1842) extends only to a particular method of effecting the rectification. Any one may burn camphine without leave or license of Mr. English, as long as he does not rectify it for the purpose according to his method; assuming, of course, that there is sufficient novelty in that method to sustain the patent, on which point we offer no opinion. Mr. English's description of his method is as follows:—

"I take a close vessel; into this vessel I introduce a pipe in connexion with a steam-boiler, so that the steam is introduced below the liquid under process, and rising up through it carries vapour therewith. From the upper part of this vessel a pipe communicates with the lower part of a second vessel. From the upper part of this second vessel a pipe communicates with the lower part of a third vessel, and so on for any number of vessels which may be found convenient. I use four, but more would be better. I place the spirit which is to be purified in the first of these vessels, either alone or mixed with water, and in some or all of the others, I place water mixed either with potassa, quicklime, soap leys, or any other alkali or alkaline substance, or else with sulphuric or some other acid, and in those vessels not containing such mixture, I place pure water. The mouth of the pipe opening into the bottom of each vessel must be below the liquid contained in that vessel, and at the lower extremity of each pipe is a bulb pierced with holes, and I prefer that each of these pipes should be in connexion with the steam-boiler, so that free steam may pass through the liquid in each vessel, and the mouth of the pipe opening into the top of the vessel must be above the contents, and part of each pipe must be so elevated that the liquid in one vessel shall not flow into another; or, in place of the steam-pipes, I apply heat to the vessel in which the spirit is contained, so as to drive the spirit over in vapour, which passes along the pipes into the successive vessels, and through the liquid contained in them. The temperature of the liquids contained in the several vessels may thus be kept above the condensing point of the vapour, either by the heat of the vapour itself, or by external heat applied to the several vessels. The vapour from the last of these vessels is conducted to a condenser, and condensed in the ordinary or any other method. The spirit is thus purified by the chemical action of the acid or alkali through which it is driven in a state of vapour, as well as by the mechanical action of the water. After the spirit has been condensed, I further purify it by filtering it through lime or any other alkaline or acid substance."

The danger of using so inflammable a spirit as rectified naphtha or turpentine is of course very considerable; and unless it can be effectually guarded against, the camphine lamps are not likely to have a very long career. The best contrived lamp for the purpose which we have yet met with is that of Mr. C. F. Smith, represented in the prefixed engraving. A is the body of the lamp for containing the camphine, or other fluid used for lighting. The air-tube, or cylinder, is composed of two separate pieces, B and C, which are united by wires, *a a*, leaving a short open space (between the parts thus united) which admits air through and among the other tubes, and at the same time prevents the heat from descending to the spirit. The wick-holder is also composed of two rings or cylinders, *b b* and *c c*, which are connected together on the one side by the rack *d* (into which the pinion on the end of the pin D gears, for the purpose of elevating and depressing the wick), and on the other by wires. The cotton wick, *e e*, is drawn over this compound cylinder, by which, in connexion with the air-tube before described, the non-conducting principle on which this lamp is constructed, is still further carried out. The wick-holder might also be made of perforated plate. *f f* is a spring or collar, whereby any excessive efflux of spirit to the flame is prevented, as well as uniformity in the height of the flame obtained. E E is the outer tube upon which the guard *g g* rests by the wire supports, *h h*, which also cut off the connexion, and consequently the communication of heat downwards. F F is a perforated plate, upon which the cone glass-holder G rests. The regulating glass-holder, *i i*, is made in such manner that, by having

the top part cut all round, and inclined inwards so as to form an expanding belt, it presses upon the cone G, being supported at bottom by small springs or wedges, *k k*, which retain it in the required position, thus forming an adjusting gallery, whereby glasses of any ordinary length of shoulder (being otherwise properly formed) can be applied at once, and the air is forced to impinge upon the flame at the proper point. H is the glass chimney.

SELF-ACTING EXTINGUISHER.



Sir,—A self-acting extinguisher is so generally useful, that I am rather surprised it is not an article of common sale. The little apparatus, of which the above sketches show one applied to a candle ready for action, and another after it has extinguished the light, I have had by me the last sixteen years. It acts by first retaining the extinguisher, supported by an almost upright stem, in its place by a thread passing from the extreme of the bent lever which carries the extinguisher, through a corresponding hole in the lower stem attached to the spring, or candle-clip, by which the whole is adjusted so as to extinguish the light at any fixed point. This thread then passes upwards through a notch cut in the side, or a hole drilled in the lower stem, or bracket, near the candle, and there terminates in an adjusting pin, having the head made sufficiently heavy to cause it to fall by its own gravity, the instant the tallow, in which it had previously been stuck, melts above it; in this state it may be seen in the figure representing the extinguished light.

No one should venture to read in a chamber, or leave lights behind them in bed-rooms, without having such, or a similar contrivance, attached to the candle. If by chance a person falls asleep, the light is shortly after put out, and the risk of fire very much diminished. Many persons, for the slight convenience of a light, leave a candle burning at home during their absence; in such, and many similar cases, it would be easy previously to attach to the candle a self-acting extinguisher. In hotels, club-houses, boarding-houses, academies, and all establishments using a number of candles, much danger would be avoided by having recourse to this simple contrivance. The same, too, happens in the rooms of invalids, to whom it would often be desirable to have a light for a short part, but not the whole of an evening.

The apparatus recommended has the advantages of quick and sure action. A slow pressure is not so good; and therefore, the instant the pin is released by the softening of the tallow, its own weight causes it to drop, and the extinguisher falls smartly down on the candle.

This is a small matter in itself, but its value is perhaps greater than may appear on first reflection; indeed it almost requires to inspect the very ware-rooms of the Birmingham manufacturer to realize, even in imagination, the produce consequent on the introduction of a new style of article in anything of general utility, no matter how apparently insignificant. I am, Sir, &c. H. D.

Surrey, March, 1844.

PROBLEMS ON STEAM POWER. BY MR. THOMAS TATE, MATHEMATICAL MASTER OF THE NORMAL SCHOOL, BATTERSEA.

[Continued from page 103.]

Example 5. Let the pressure of the steam in the cylinder be 40 lbs., the length of the stroke 4 feet, the clearance 2 inches, and let the steam be cut off at 2 feet of the stroke; required the advantage arising from working the steam expansively.

In this case

$P=40$, $H=2$, $h=2$, $c=\frac{2}{12}=\frac{1}{6}$. Let the part over which the steam works expansively be divided into four equal parts, that is, let $m=4$, then

$$P_n=\frac{1}{\left(1+\frac{2n}{8}\right)\left(\frac{1}{40}+\cdot 00268\right)-\cdot 00268}=\frac{1}{\left(1+\frac{n}{4}\right)\times\cdot 02768-\cdot 00268};$$

$$\therefore\ P_1=31\cdot 3,\ P_2=25\cdot 8,\ P_3=21\cdot 2,\ \text{and}\ P_4=19.$$

Hence by (2), $U=126\cdot 7$.

If the pressures be determined by Marriotte's law, 1, it will be found that, $U=128\cdot 7$, making only the small difference of two units.

Now if we suppose the steam to act uniformly throughout the whole of the stroke, the units of work will

$$=40\left(4-\frac{1}{6}\right)=153\cdot 3.$$

But the steam employed in this latter case is double that of the former,

$$\therefore\ \text{The advantage}=126\cdot 7-\frac{153\cdot 3}{2}=50.$$

9.—*To find P when L is given.*

Let the value of the pressures determined in 1, be substituted in 2; then as P forms a factor of all the pressures, we have by transposition and division, and afterwards eliminating U by 4,

$$P=\frac{3\,m\{U+p\,(H+h-c)\}}{H\,(1+q)+3\,m\,(h-c)}=\frac{3\,m\,(H+h-c)\,(L+p)}{H\,(1+q)+3\,m\,(h-c)},\ \text{where}$$

$$q=e\left\{\frac{1}{e+m\,H}+4\left(\frac{1}{e+H}+\frac{1}{e+3\,H}+\frac{1}{e+5\,H}+\dots\right)+2\left(\frac{1}{e+2\,H}+\frac{1}{e+4\,H}+\dots\right)\right\};$$

and e is put for $m\,h$.

Example 6. What must be the elasticity of the steam in the cylinder, when the gross load is 22 lbs. per square inch, the length of the stroke 5 feet, the area of the piston 600 inches, the elasticity of the steam in the condenser 2 lbs., and the steam is cut off at 2 feet of the stroke?

Here $L=22$, $H=3$, $h=2$, and c is neglected. Let the remaining part of the stroke be divided into 6 equal spaces, then $m=6$, $e=m\,h=6\times 2=12$, and,

$$q=12\left\{\frac{1}{30}+4\left(\frac{1}{15}+\frac{1}{21}+\frac{1}{27}\right)+2\left(\frac{1}{18}+\frac{1}{24}\right)\right\}=9\cdot 98.$$

$$\therefore\ P=\frac{3\times 6\times 5\times 24}{3\times 10\cdot 98+3\times 6\times 2}=31\ \text{lbs.}$$

10.—*To find the elements composing L, in the Double-acting Engine.*

Hitherto we have chiefly confined our attention to the moving force of the engine; but it will now be expedient to consider, more in detail, the resisting forces, in order that we may be enabled to determine the effective or useful work of the engine.

To the work of the steam, or U determined 2, is opposed the useful or actual work plus the work destroyed by friction. The magnitude of this friction will, obviously, depend upon two elements, viz., the surface of the piston, and the weight moved; let, therefore,

$$K\,L=K\,F+K\,L_1+f\,K\,L_1;\ \text{or}\ L=F+L_1\,(1+f)\dots\ (A),$$

where K L is the actual weight raised by the engine, K F the resistance of friction when the engine works without any effective load, and f that co-efficient of friction which arises from the useful load L_1. It is easy to see that F is independent of f. In order to determine F and f, therefore, we have by equality 4.

$$F + L_1 (1+f) = \frac{U}{H+h-c} \ldots (B).$$

1. To determine F let p^1 be the pressure of the steam in the boiler, so as just to move the unloaded piston from the bottom to the top of the cylinder, then in this case $L_1 = 0$, and owing to the slow motion of the piston p^1 will also be, very nearly, the elasticity of the steam in the cylinder,

$$\therefore F = \frac{U}{H+h-c},$$

where U is the units of work of the steam at p^1 pressure.

2. To determine f. Having found by experiment the pressure P corresponding to the greatest actual load L_1 with which the engine can work, we have by B,

$$f = \frac{U-(F+L_1)(H+h-c)}{L_1 (H+h-c)}.$$

These constants being thus determined for the particular engine, we have from equation B, generally, the useful work upon 1 inch

$$= \frac{U-F(H+h-c)}{1+f} \ldots (D)$$

This value substituted for U in (3), will give the useful or effective horse powers.

Example 7. In example 5, if $p^1 = 6$lbs., and the elasticity of the vapour in the condenser = 4 lbs.; it is required to determine F.

Let the remaining part of the stroke be divided into four equal parts, then by the reduced expression for Pole's formula, we find the pressures as follows, viz., 6, 4·7, 3·9, 3·4, 2·9; whence U = 3·8,

$$\text{and } F = \frac{U}{H+h-c} = \frac{3\cdot8}{3\frac{5}{8}} = 1 \text{ lb.}$$

For large engines the value of F has been found to average about ·5 lbs.

Example 8. Let L_1 = 25 lbs. in the example just cited; required the co-efficient of friction due to the useful load.

$$\text{Here } U = 126\cdot7 - 4 \times 3\tfrac{5}{8} = 111\cdot4, \text{ and } F = 1,$$

$$\therefore f = \frac{111\cdot4 - 26 \times 3\frac{5}{8}}{25 \times 3\frac{5}{8}} = \cdot12$$

11.—*To determine the maximum work in a cubic foot of water in the state of steam at a given pressure P.*

It will be convenient to consider the work which steam is capable of performing under three aspects. 1st. the work performed whilst the steam is being formed; 2nd. the work performed by its expansion; and 3rd. the work by its condensation. The third source of power merges in the two former, upon considering that it is just equivalent to the atmospheric resistance. Conceive the cubic foot of water to be placed in a cylinder whose piston contains 144,000 square inches; let heat be applied so as slowly to raise the piston with a pressure of P lbs., until the whole of the water is converted into steam, then the volume of this steam at this point will be expressed by the relation $V = \frac{n}{P} + m$. After this the steam will continue to perform work by its expansion, until its elasticity is equal to the pressure of the vapour above the piston plus the friction of the parts of the machine. The volume of the steam, at this limit, will therefore be found by the preceding formula, whence also the stroke of the piston will become known, and the units of work may then be calculated by 2. In calculating the pressures at the different intervals of the stroke, it will be most convenient to use the relation $P = \dfrac{24250}{\frac{M}{S} - 65}$.

Example 9. Required the units of work in a cubic foot of water in the form of steam, at the pressure of 60 lbs. per square inch, supposing the resistance of friction and the vapour in the condenser to be 5 lbs. The height of the water in the cylinder $= \frac{1}{1000}$, or ·001 feet. The height of the piston when the water is all evaporated = ·467 feet. And the height of the piston when the pressure of the steam is 5 lbs., or when all the work is expended = 4·624; therefore, the space over which the steam works expansively = 4·624 — ·467 = 4·157 feet; and the space over which the steam works with the uniform pressure of 60 lbs. = ·467 — ·001 = ·466 feet.

Let the expansive part of the stroke be divided into 8 equal parts, then the interval between the pressures

$$= \frac{4\cdot157}{8} = \cdot5196 \text{ feet};$$

and the pressures at the commencement of each interval will be, 60, 26·3, 16·8, 12·3, 9·7, 8, 6·8, 6, and 5 lbs., respectively. The work performed upon 1 inch of the piston by the steam, during its formation = 60 × ·466 = 27·96. The work destroyed by friction and the uncondensed vapour

$$= 5 \times (4·624 - ·001) = 23·115$$

$$\therefore \text{by } 2,\ U = \frac{·5196}{3} \times 342 + 27·96 - 23·115 = 64·079$$

and the total units of work upon the piston = 64·079 × 144,000 = 9,227,000 nearly.

If a bushel of coal reduce 10 cubic feet of water to the state of steam, then, according to the foregoing calculation, the maximum duty of steam at 60 lbs. pressure will be upwards of 90,000,000; which is considerably more than any of the Cornish engines have yet attained. At the same time it is proper to observe, that a considerable portion of work is absorbed in these engines by the clearance. Any contrivance calculated to reduce the waste of steam thus occasioned would be well deserving public attention. By calculating, as in the preceding example, it will be found that the units of work in a cubic foot of water increase with the pressure at which the steam is generated.

12.—*To determine* P *so as to yield the greatest work from a given weight of steam,*

We here propose to show, generally, that the units of work in a given weight of water increases with the increase of pressure at which the steam is generated.

Let P (see fig. 2) be the position of the piston when the steam begins to act expansively, and P_1 the position of the piston in another case, when the steam begins to act in the same manner. Then as the weight of the steam is the same in both cases, the pressures at and after P will be the same in both cases, therefore the units of work performed after that point will also be the same, but the work performed from O to P_1 is greater in the first case than it is in the second, because the pressures are greater in the former than they are in the latter case; hence, it follows that the work performed by a given weight of steam will increase with the pressure at which that steam is generated.

To appreciate the importance of this result it is necessary to observe, that since the sum of the latent and sensible heat of vapour is a constant quantity, it follows that there must always be the same quantity of heat in the same weight of steam, whatever may be its pressure or temperature. Hence, therefore, the work performed by a given weight of fuel will be greatest when the pressure, and consequently the temperature, at which the steam is raised is greatest; hence the fallacy of the opinion entertained by some writers, that there is no advantage gained by using steam of high pressure.

It appears, from what has just been proved, that in order that an engine should perform the greatest work with a given weight of fuel, the following conditions must be observed. 1. The steam must be used of the greatest practicable pressure. 2. The piston must move, and the other parts of the engine must be constructed, so that the least possible change shall take place in the volume of the steam whilst passing from the boiler to the cylinder. 3. The steam must be cut off so that the whole of its work shall be taken up.

13.—*To determine the point of the stroke at which the steam, working with a given pressure, must be cut off, so as to yield the greatest amount of work in a Double-acting Engine.*

The whole of the work will have been taken out of the steam when the sum of the resistances upon the piston in which there is no useful work, is equal to the moving pressure; that is, when the elasticity of the steam is equal to the elasticity of the vapour in the condenser, plus the friction produced by the motion of the engine. Let r, therefore, be put for this resistance, and we shall have, by 10, $r = F + f L, + p$, where p is put for the pressure of vapour in the condenser. As the relative dimensions of the cylinder cannot effect the work done, we have

$$\frac{h}{H + h} = \frac{\text{vol. steam at P pressure}}{\text{vol. steam at } r \text{ pressure}}.$$

But $S\left(\frac{n}{P} + m\right)$ and $S\left(\frac{n}{r} + m\right)$ are the volumes of the same weight of

steam at P and r pressures respectively, therefore by substitution,

$$\frac{h}{H+h} = \frac{\frac{n}{P} + m}{\frac{n}{r} + m}.$$

From which relation, any two of the three quantities h, H and P being given, the remaining one may be found.

Example 10. If the length of the stroke be 10 feet, and if steam at the pressure of 40 lbs. be admitted into the cylinder, at what point of the stroke must the steam be cut off, so as to yield all its work, when the resistance of the vapour in the condenser plus the friction of the engine = 5 lbs. per square inch of the piston?

Here $H+h=10$, $P=40$, and $r=5$.

$$\therefore h = \frac{10\left(\frac{24250}{40}+65\right)}{\frac{24250}{5}+65} = 1\cdot3 \text{ feet.}$$

14.—*To determine P in terms of S cubic feet of water evaporated per minutei n a Double-acting Engine.*

The volume of steam evaporated per minute at the pressure $P = S\left(\frac{n}{P}+m\right)$.

The expenditure of the steam per minute $= \frac{NKh}{144}$.

$$\therefore \frac{NKh}{144} = S\left(\frac{n}{P}+m\right) \dots (c);$$

$$\text{whence } P = \frac{n}{\frac{NKh}{144S}-m}.$$

Example 11. An engine makes 12 strokes per minute, the area of the piston = 2000 inches, the steam is cut off at 3 feet of the stroke, and the water evaporated per minute = $\frac{1}{4}$ cubic foot; required the pressure of the steam in the cylinder.

Here $N=12$, $K=2000$, $h=3$, and $S=\frac{1}{4}$

$$\therefore P = \frac{24250}{\frac{12 \times 2000 \times 3}{\frac{1}{4} \times 144} - 65} = 25 \text{ lbs.}$$

15.—*To find U in terms of S, in a Double-acting Engine.*

In order to effect this we have only to substitute the value of P, obtained in the preceding article, in equation 2. Then this value of U substituted in equation D, 10, will give the useful load.

Example 12. If the length of the stroke = 9 feet, the steam being cut off at 1 foot, the area of the piston = 4000 inches, the number of strokes performed per minute = 16, the clearance = 6 inches, the pressure of the vapour in the condenser = 3 lbs., and the water evaporated per minute = ·75 cubic feet; required the useful load, supposing the friction of the unloaded piston = ·8 lbs. per square inch, and the additional friction = $\frac{1}{7}$ of the useful load.

In this case, $h=1$, $H=8$, $K=4000$, $N=16$, and $S=\frac{3}{4}$: $\therefore$ by 14,

$$P = \frac{24250}{\frac{16 \times 4000 \times 1}{144 \times \frac{3}{4}} - 65} = 46 \text{ lbs. nearly.}$$

Let the space over which the steam acts expansively be divided into eight equal parts, then calculating the pressures by Marriotte's law we find by 2,

$$U = 99\cdot1, \therefore L = \frac{99\cdot1}{8\cdot5} = 11\cdot6 \text{ lbs.}$$

By 10, $L = F + L_1 (1+f)$, or $11\cdot6 = \cdot8 + L_1(1+\frac{1}{7})$, whence $L_1 = 9\cdot4$ lbs. nearly.

16.—*To find the water evaporated in a given Double-acting Engine working with the pressure P.*

From equation c, 14, we find by division, $S = \frac{NKh}{144\left(\frac{n}{P}+m\right)}$ which gives the value of S when P is given.

Obs. If the load be given, then P may be found by 9.

Example 13. Required the cubic feet of water evaporated per hour by the engine of Ex. 2.

Here $K=4000$, $N=12$, $P=30$, and $h=3$.

$$\therefore S = \frac{12 \times 4000 \times 3}{144\left(\frac{24250}{30}+65\right)} = 1\cdot14 \text{ feet per minute;}$$

and the number of cubic feet evaporated per hour $= 1\cdot14 \times 60 = 68\cdot4$.

Example 14. If the friction, in examples 2 and 13, be estimated at 2·5 lbs. per square inch of the piston, how many units of useful work will the engine perform with 1 cubic foot of water? Here U = 170·9; ∴ the useful work in one stroke upon 1 inch of the piston = 170·9 − 9 × 2·5 = 148·4; and the useful work upon the whole piston in 1 minute = 4000 × 148·4 × 12; but by the last question the water evaporated per minute = 1·14 cubic feet; ∴ the units of useful work performed by 1 cubic foot of water

$$= \frac{4000 \times 148{\cdot}4 \times 12}{1{\cdot}14} = 6{,}000{,}000 \text{ nearly.}$$

17.—*To find N in the Double-acting Engine.*

From equation *c*, 14, we readily obtain

$$N = \frac{144\ S\left(\frac{n}{P} + m\right)}{K\,h};$$

which gives the number of strokes per minute in terms of P.

Obs. If the load be given, then P may be found by 9.

Example 14. If the area of the piston = 1152 inches, the length of the part at which the steam is cut off = 2 feet, the pressure of the steam = 40 lbs., and the water evaporated per minute = ·5 cubic feet, required the number of strokes performed per minute.

In this example K = 1152, h = 2, P = 40, and S = ·5.

$$\therefore N = \frac{144 \times {\cdot}5\left(\frac{24250}{40} + 65\right)}{1152 \times 2} = 20{\cdot}9.$$

Example 15. Let the surface of the piston = 1800 inches, the length of the stroke, including the clearance = 10·5 feet, the clearance being ·5, the effective evaporation ·927 cubic feet per minute, the pressure of the steam in the cylinder = 50 lbs. the elasticity of the vapour in the condenser = 4 lbs., the total resistance of friction = 2·5 lbs. per square inch of the piston. Required, 1st, the point at which the steam must be cut off, so that all its work may be taken up; 2nd, the number of strokes performed per minute; 3rd, the useful work; 4th, the effective horse-powers; 5th, the duty of the engine, allowing that 1 bushel of coal can evaporate 10 cubic feet of water; 6th, the height to which a cubic foot of water will raise itself in this engine.

$$\text{By 13,}\quad h = \frac{10{\cdot}5\left(\frac{24250}{50} + 65\right)}{\frac{24250}{6{\cdot}5} + 65} = 1{\cdot}52 \text{ feet.}$$

As near enough for our purpose we shall take h = 1·5. By 17,

$$N = \frac{144 \times {\cdot}927 \times 550}{1800 \times 1{\cdot}5} = 27 \text{ nearly.}$$

Let the space over which the steam works expansively be divided into 6 equal parts, then calculating the pressures by Pole's formula, we have

$$U = {\cdot}5\left\{50 + 6{\cdot}5 + 4\,(23{\cdot}4 + 11{\cdot}3 + 7{\cdot}5) + 2\,(15{\cdot}3 + 9)\right\} + 50 \times 1 - 10 \times 4 = 146{\cdot}9;$$

The useful work upon 1 inch of the piston = 146·9 − 2·5 × 10 = 121·9; and the useful work performed per minute = 121·9 × 1800 × 27 = 5,900,000 nearly;

$$\text{the effective H. P.} = \frac{5{,}900{,}000}{33{,}000} = 179;$$

the work of a cubic foot of water

$$= \frac{5{,}900{,}000 \times 1}{{\cdot}927} = 6{,}300{,}000 \text{ nearly;}$$

the duty of the engine

= 6,300,000 × 10 = 63,000,000;

and the height to which a cubic foot of water would raise its own weight

$$= \frac{6{,}300{,}000}{62{\cdot}5} = 100{,}000 \text{ feet nearly.}$$

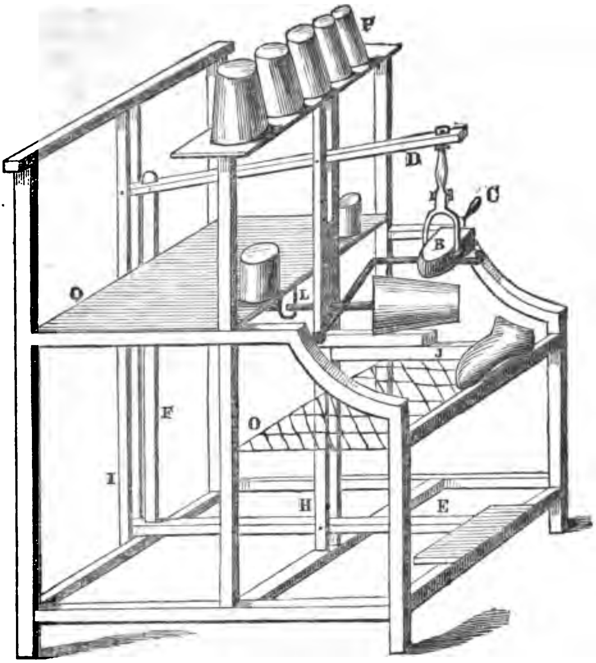
(To be continued.)

PRICE'S MACHINE FOR BLOCKING AND PRESSING STRAW BONNETS.

The object of bonnet-pressing is to give to he work a smooth and finished appearance after the plait is sown together.

The operation is usually performed by plcaing the bonnet on a wooden block of the required form, and pressing it with a eated box-iron, a damp cloth having been first applied to it to prevent the material from being discoloured.

The blocker increases the pressure of the iron by throwing the weight of his body upon it—a rude method, and one not unfrequently productive of serious bodily injury.



"Necessity," according to the old adage, "is the mother of invention," and seldom has this truth being more strikingly exemplified than in the present instance. A blocker of the name of Vincent Price, became so afflicted from an aneurism, that he found he must abandon the business unless he could contrive a machine which would effect the pressing without the bodily pressure. He accordingly set about the task, and has succeeded so well as to produce an apparatus, by which, not only the bodily pressure is dispensed with, but twice the number of bonnets is pressed in a given time, that can be turned out of hand in any other way. The Society of Arts (during the administration of Mr. Graham,) awarded to Mr. Price their Silver Medal for his invention; and our present account of it is made up partly from the last Part of their Transactions, and partly from some communications made directly to ourselves by the inventor.

A is one of the blocks in a position to receive a bonnet; B is the box iron with its handle C, which is hung with double joints and swivel to the lever D, which is connected to the treadle E, by means of the vertical bar of iron F, the weight of which is sufficient to overbalance the box-iron B and the treadle E.

Instead of standing, as usual, the blocker sits on the stool G, and by his feet on the treadle lowers the box-iron, the pressure of which he can vary from an ounce to upwards of 5 cwt., and which he can also guide and turn in any direction by the handle C.

The middle upright bars, H and I of the frame, are made double, to serve as guides to the lever D and treadle E, and also to receive the moveable cross-bar J, which supports the block A. When the sides are to be blocked, the axis K is drawn forward out of the metal socket L, and the block A, placed on the end of it. To the axis K is attached an arm M, which is moved by either hand of the blocker, so that the bonnet may be turned quick round under the iron: the arm has a balance weight N.

O O is a net stretched across the whole space before the blocker on which the bonnet may be laid. P and Q are two shelves on which to place blocks of different sizes.

Mr. Price now manufactures the apparatus for the bonnet trade, from which he is deservedly receiving every encouragement. His address is 33, Wardour street, Soho.

THE HISTORY OF ELECTRO-METALLURGY, AND MR. C. J. JORDAN.

Sir,—The very flattering manner in which my claims in connexion with the discovery of electro-metallurgy have been recognized in your pages, demands from me a grateful acknowledgment. When my communication of May 22, 1839, appeared in your Magazine, it was submitted to public consideration to avert, as far as possible, a loss of precedence impending on further delay in its publication, coupled with the conviction, that if worthy of attention it would receive it in the end. Although it would be untrue to deny that disappointment was felt at the neglect it met with; yet, to have murmured at the tardiness of public judgment would have been a step without immediate object. Reflecting also, that in whatever light my letter may have been viewed, nothing advanced therein had been disputed, I determined to remain silent on the matter, and wait the arousing of public attention by other hands—a consummation which I foresaw must, in some way or other, ultimately take place. The expectation has been realized, and I have been indulged with the accession of a vigorous advocate in one of your ablest correspondents, whose contributions to a "History of Electro-metallurgy" have set the matter in a much clearer light than I feel myself qualified to have done. Whatever may be the relation of this gentleman with other individuals mentioned in his paper, with myself it is purely impersonal. The comprehensive exposition of Mr. Dircks appears to have been dictated solely by an impartial spirit, and a just perception of the merits of the case with a view of eliciting truth. In return for his valuable exertions in my cause, I beg to express my sincere thanks.

It may be necessary to mention here, that at the time of the publication of the second "Contribution," &c., its author was personally unknown to me; but that in consequence of a conversation with Mr. Brown, Librarian to the Mechanics' Institution, I was induced to open a communication with Mr. Dircks, which led to an interview with that gentleman, February 28.

I am fully sensible, Sir, of the honour done me by your concurrence in the conclusion drawn by Mr. Dircks; and I may be permitted to say, that all previous disappointment is amply compensated by your approval and final decision in my favour—conveyed too in a tone of warm eulogium, most gratifying, as coming from one to whose position and repute in the literature of the arts the highest respect pertains.

In regard to Mr. Spencer, a few remarks may be expected from me: they must at present be brief, and will convey the intimation, that I am as little disposed to view his labours in electro-metallurgy with jealousy, as I am inclined to relinquish my identification with its discovery. I await with some interest the advent of his promised documents, which are to annihilate all further rivalry—or otherwise. In either event I shall remain satisfied, being conscious of the difficulty he will encounter in extinguishing my claim to the character of an independent originator of this art, or in setting aside my incontestable priority in publication.

I remain, very respectfully, yours,

C. J. JORDAN.

March 8, 1844.

THE DISCOVERY OF ELECTROGRAPHY.

Sir,—I nowhere find in Mr. Dirck's last communication that *he* refuses the terms I proposed; but *you* do, in your editorial capacity, I suppose on his authority; and add, that "I am in no condition to stipulate terms." Indeed! And what was the gist of the proposed terms? That after Mr. Dircks had fully made his charge, I should reply—then submit both cases, after having been printed, to a competent committee, and whatever decision they came to, I should feel myself bound to abide by it—*and this is not accepted!* I said at the outset, with regard to Mr. Dircks, that I wished I had an opponent of whose honest intentions in the cause of truth I was better assured. I cannot help thinking that if I had had an honest opponent, there could have existed no possible difficulty, in accepting such terms, they being, what all men desirous of settling a matter fairly, readily agree to. There is no man that I would have sooner left it to than yourself, from all I have hitherto seen of your conduct in the Magazine; but, Sir, you can scarcely expect that now, seeing that you have already pronounced an opinion on the matter at issue, and that, too, from only one side of the question, and which, I speak with deference, if you had read carefully, warranted a very different conclusion.

You further add, that it was easy for me to say when I claimed the invention—that I

knew nothing of Mr. Jordan's letter, had never seen it, never read it, never heard of it. I assure you most solemnly I could have said so in the sincere spirit of truth, *if I had thought this gentleman's letter in any degree affected my claims*, after having read it the other day in your Magazine, for the first time.

You also seem to be in much haste to see my reply—so does Mr. Dircks. I really do not see why I should withhold it now, unless it be to insure fair dealing, and perhaps let Mr. Dircks save me trouble—as he has half done already—which a careful analysis of his papers will show; however, let my reply come when it may, depend on me, I shall take care it has justice.

For the second time I protest, in the strongest terms, against your allowing the Magazine to convey garbled statements of things that are quite foreign to the matter at issue; nor do I know of any thing more dishonest than that of quoting part of a statement, when the whole would convey a different meaning. I refer to the experiments I lately made on clairvoyance. A part of a paragraph, containing an account of one of them, was quoted by Mr. Dircks; but, had the whole been given, it would have conveyed a very different impression. As editor, you surely had it in your power to draw your pen through that which had no relation to the matter, more especially when I had remonstrated with you by private letter the first time it was alluded to. Should I send you a paper on the subject, I am sure you would not insert it, and you would be acting consistently with the interests of the Magazine. It therefore being a subject so foreign to your pages, it savoured something of partizanship to give a portion of it, obviously but to wound. I am, with much respect,

THOMAS SPENCER.

P.S. I am half inclined to think that from the beginning I have taken this matter up too seriously; the animus of Mr. Dircks must have been very apparent to all, yourself included; and yet, in every communication, you permit him to persist in making statements, and imputing motives, meant to [illegible] injurious to myself, and having no other [illegible]undation than his bare word. Really, [illegible], unless I see at least the semblance of [illegible]r play on your part, I must give the [illegible]atter up in the pages of the *Mechanics' [illegible]agazine.*

T. S.

[We could draw no other conclusion from [illegible] manner in which Mr. Dircks treated [illegible]r. Spencer's proposition for a reference to [illegible] competent committee," &c., than that did reject it, (though not, certainly, in express terms,) and Mr. Dircks himself has not disputed the correctness of our conclusion. We are still of opinion that such a mode of proceeding was altogether uncalled for; and though Mr. Spencer may (affect to) wonder at this, we are sure nobody else does. Mr. Spencer finds fault with us for permitting Mr. Dircks to assail him in this way and the other on the strength of his "bare word;" and threatens, "really," that "unless he see at least the semblance of fair play on our part," he must go elsewhere to obtain it. Mr. Spencer will do as he pleases in this respect; but we must distinctly deny that he has the slightest pretext for saying that he has not received fair play at our hands. He has been hit hard through the columns of the Magazine—that is true; but at the same time every opportunity has been promptly afforded to him of defending himself through the same medium—*if he could.* Mr. Dircks may have latterly diverged a little more from the main points, it is true, than is proper, and have used greater acerbity of language than it is pleasant to observe; but we could not but feel that the unwarrantably disparaging manner in which he was replied to by Mr. Spencer (who could find time for that, though he could not find a moment to bestow on the "stubborn facts" of the case) gave him strong claims to indulgence.—ED. M. M.]

ON THE NEW METHOD OF MEASURING DISTANCES—BY MR. HENRY HENNESSY.

Sir,—Although I did not intend to carry on the discussion of a subject which has been already examined, I cannot refrain from making some remarks on the plausible and elaborate dissertation which appears in p. 86 of this volume.

The first objection that "G." brings against my method of measurement, is the great inequality of the sides of the triangles. Ill-conditioned as they may be from that cause, they have some advantages over the triangles of an ordinary survey. They are always *right* angled. Their other advantages will be easily seen by reference to my paper, (vol. xxxix., p. 276.)

"G." seems to imagine, that in ordinary trigonometrical measurements the sextant, or some similar instrument, capable of being carried under the arm, is used. I have always used the theodolite, and have seldom seen other instruments used for the purpose.

"G." says, (p. 87,) "the adjustment of the portable base to the proper height will, unless an assistant be employed, be an exceedingly tedious, if not impracticable operation." The ordinary method of surveying requires at least one assistant to the sur-

veyor, often more than one. "G.'s" objection to my method applies, therefore, to every other.

He further says, that my method cannot be applied to the measurement of inaccessible distances, as determining the width of a river, "*unless*, indeed, a boat be procured to carry over the portable base." The same difficulty is experienced by an engineer when he meets a river on a line which he is levelling. The levelling staves must be carried across. "G." would not say that levelling is inapplicable to rivers from this cause.

The next objection is, that the method can be used only when the ground is level, or declines from the observer. This objection is extremely futile, as the observer can place himself in any position at the commencement of the line. If the ground does not decline from him at one extremity of the line, it must at the other extremity.

The construction of the proposed instrument next occupies "G.'s" attention. He very properly mentions in a note, that it was unnecessary to make the radius equal to the base, if the only object in so doing was the elimination of the radius from the formula. The real object was, however, to allow the arc to be minutely divided. This equality of the radius with the base is not insisted on, for if in practice it were found to be much weakened by its length, it could be shortened to half the proposed length, still admitting of very minute division on the arc.

There can be no comparison between the proposed instrument and the instruments at the Greenwich Observatory. As the distances measured by the former will probably be never less than 40 feet, the arc (allowing the radius to be 5 feet) will be about 9 inches in length, or nearly the 35th part of the circumference.

The equatorials, mural circles, and other angular instruments used at the Observatory, are complete circles, with radii half as long as that of the proposed instrument, and have arcs seventeen times and a half as great. The well-known maxim of the inverse proportion of size and strength is, therefore, so far entirely in favour of my instrument. Also the effects of expansion and contraction from change of temperature will be seventeen times and a half less than in the instruments to which "G." alludes. By shortening the radius one-half, the errors arising from these causes will be thirty-five times less than in the astronomical instruments. It should be also remembered that the complicated machinery necessary for directing an astronomical instrument to every quarter of the heavens, does not at all accompany this instrument.

When in use the proposed instrument could be supported similarly to the theodolite, and when not used it could be easily disposed in a properly constructed case, instead of being "lugged about on a man's back, or in some such uncouth mode." From these observations I think I am perfectly justified in considering that "G." has much overrated the probable error in taking the angle of depression for a distance of 500 feet when he assigns it at 5 seconds. His conclusion that there will be an error of 1 foot 2½ inches is therefore incorrect.

With distances of between 300 and 400 ft., "G." himself must admit that the error of observation will be *practically* insignificant. Levelling being the chief use to which this instrument can be applied, as it gives the difference of level and horizontal distance; distances of 400 feet will be seldom, if ever, exceeded. It will be perceived that "G." has not attempted to deny the utility of the instrument in levelling. The time employed in adjusting the common theodolite or level is nearly the same as that which the adjustment of the instrument proposed by me would occupy. But the results given by the latter would be more important, and therefore its use in levelling has not been disputed.

Cork, March 9, 1844.

THE JET QUESTION.

Sir,—I would not be tempted to continue a theoretical discussion on the subject of the jet, were it not that I am called on by so intelligent a writer as your correspondent, Mr. Cheverton, to apologize to a third party for a quotation I made, or rather for misconceiving the drift of the experiments made by that party. I cannot bring to my recollection the observation made by Mr. Talbot in describing these experiments, but I have no doubt about having stated accurately the facts, and I believe they had no reference whatever at the time, to the experiments of the jet impinging against a disc, or to that controversy.

Your correspondent thinks there is nothing extraordinary in these experiments, or contrary to what might be expected when the same are manifestly at direct variance with his own mathematical formula. If the latter be erroneous, no doubt the remark might have some weight, and if there be nothing very remarkable, why insinuate their inaccuracy? He should not, however, if he follows the doctrine of Venturi, test the accuracy of philosophical experiments by theoretical inductions. What I contend for is this, if the accuracy of these experiments is to be disputed by your correspondent, they

must be met by an experimental enquiry, showing different results, and not by theory, even though based on the highest authority. "I have carefully," says Venturi, "abstained from theory in other experiments, and never introduce it but when it combines with the results of experiments."

Your correspondent contends that I confound two matters, and do not make a proper distinction between the initial velocity and that of the velocity of the current; but he contends that the initial velocity is effected by the density of the opposing medium, contrary to the results of these experiments, and admits that the consumption of the fluid in the reservoir is a measure of the same; while he, at the same time, truly states, that the retardation of the jet as a current, cannot be measured comparatively in the same way. But is this any proof that I confounded these two states, and that I mistook one for the other? Does not his own admission satisfy him that I was correct in the view I took of them—that these experiments were the strongest proof of the accuracy of Venturi's observation, and made the solution of the other problem a difficult task?

Your correspondent wishes to vary the experiment by immersing the orifice of the jet some distance in the mercury; but if he does so, he must let the head of water still continue the same distance of 4 feet from the surface of the masonry; and if he does, I am very much inclined to think, that in that case there will be no variation in the experiment. It is one, however, that is deserving of being tried. That portion of the experiment, however, where the fluid had been put in motion, both in favour of the jet, and against it, which your correspondent overlooks, I think settles the question, and removes any doubt on that point; and until those experiments are disproved by others, showing a very different result, they must, in opposition to all theory, be supposed to be accurate. Because, forsooth, these experiments do not square with the theoretical views of your correspondent, the result furnished by them must be miraculous! And this, too, an observation emanating from a writer whose boast is, that he has the greatest contempt for all mathematical theories, and that the plain common sense of the practical man is far more to be depended on than the theoretical deductions of the ablest mathematician.

I am, Sir, Yours, &c.,

X. Y. Z.

DRAINAGE IN DEMERARA.

(From the *Greenock Advertiser.*)

On looking over our Demerara papers we observe a description of draining machinery, sent out some time ago by William Maxwell Alexander, Esq., of Southbar. All persons acquainted with the colony must be aware of the importance of drainage, of the enormous expense that has been laid out to effect it, and of the partial success that has hitherto attended all efforts for its attainment; we therefore regard the success of this machinery as of the greatest importance, as not only likely but certain to render estates in that colony most valuable property, which, from defective drainage alone, have hitherto been worth little or nothing. To Mr. Alexander, who is so well known for his efforts in the improvement of agriculture, the highest meed of praise is due for the spirited manner in which he took upon himself the whole risk and expense of the experiment; and to Messrs. Scott, Sinclair, and Co., the manufacturers of the machinery, for the engineering skill and ability they have employed in adapting so exactly the various contrivances to the circumstances of the locality in which it was to work.

The following remarks are from the *Guiana Herald* of the 22nd of December:—

Every planter must know that the great *primum mobile* of successful cultivation in this colony is drainage; and yet, great as this desideratum confessedly is, it is perfectly astonishing how little has hitherto been done by our agriculturists, beyond the most simple and obvious means, to overcome, by mechanical aids, the local disadvantages of a flat country. Go on every estate in the colony, and you will see the assistance of mechanics invoked in every possible way about the manufacture of the sugar. While the clanking and whirling engine crushes and squeezes the luscious canes, they will also be found regularly and steadily drawn up, by a beautifully simple mechanical contrivance, to be thrown into the mill. The same motive power also conveys the expressed juice to the boiling-house, and despatches, up steep railways, or otherwise, the valuable megas to its appropriate storing place. In fact, throughout the whole of the manufacture of sugar, or the preparing of coffee, you see our deficient manual labour supplied in every possible way by the far more effective agency of machinery. But, go beyond the precincts of the estate's buildings, and then you notice the over-flooded fields and teeming drains, and ask why this superfluous water is allowed thus to stagnate, rotting and destroying the standing crop; and you are straightway told something about a shell bank, or a caddy bank, or the back lands being low, and those in front high,—all being conclusive reasons in their way, but by no means improving matters. Surely, under such circumstances, it will strike even ordinarily obser-

vant people to enquire why, when at the time that we have done so much in one department of our estates' economy by machinery, we should have altogether neglected to apply its powers in the most material department—the drainage? And really this neglect becomes the more unaccountable, when we recollect that the original settlers of the colony—the Dutch—must, of all people, have been the best acquainted with the advantages of machinery in draining low swampy lands.

Many years ago Mr. Neilson made some attempts at draining the Haags Bosch, through Canal No. 3, by means of machinery; but either finding his contrivance defective, or the estate passing into other hands, who had the means of effecting drainage through a more natural course, the matter was abandoned. More recently, Mr. George Brooker attempted to drain the Cane Grove by means of a steam-engine, working, we believe, a bucket-wheel. From some cause which we have not learned, this essay also was unsuccessful.

Yesterday, however, we witnessed at work, on the Turkeyen estate, the property of W. M. Alexander, Esq., of Southbar, a draining machine of the most effective, yet simple construction that can be imagined. Let us attempt to describe it. The motive power is a compact high-pressure engine of sixteen-horse power, making forty strokes in the minute. It drives a large wheel, which makes seven entire revolutions in that time. To this wheel are attached wooden flaps of about 3 feet in length, and 1 in breadth, similar to the paddles of a steam-boat, but placed on the wheel differently, their length lying along, instead of at right angles with, the course of the radii of the wheel. These flaps, in the revolutions of the wheel, dip into a brick box accurately fitting them, and therefore concave at the base. Into this the water rushes, and by the propulsion of the wheel is constantly forced forward in a perfect torrent over a brick wall sloping outwards, over which being thrown it cannot return. The contrivance, we repeat, is simple and effective in the highest possible degree. While at work yesterday it reduced the water about one foot and a half in twenty minutes; and we learn that, by accurate measurement and calculation, on a former occasion, it relieved the estate of twenty-eight thousand cubic feet or eight hundred tons of water in the space of thirty minutes.

And at what cost, thinks the reader, is this inestimable benefit to a coast estate secured? Mr. John King, of King, Brothers, and Co., of Greenock, the attorney and talented manager of the property, assures us that he can work the engine for eight hours, (being at least two hours longer than even in the heaviest weather can ever be required,) for the sum of five dollars for fuel.

To test, in the most conclusive possible manner, the powers of this draining machine, Mr. King has closed the draining tunnel of the estate, and, in the present and coming rainy weather, trusts entirely to this mechanical assistance for the drainage of the estate.

We understand that last year the cost in labour alone expended on the estate to *endeavour* to effect drainage, was nearly fifteen hundred pounds sterling. Now, not only was this an outlay that no estate can stand, but a still greater evil was involved—it abstracted that amount of labour from the cane fields. At present, and in future, this estate will be drained at a cost of less than two hundred pounds sterling per annum, while the only draught laid upon the labouring strength of the estate will be the service of two old people to attend the engine when at work, which will be, we suppose, for about one-third of the year.

We regard this eminently successful experiment at the Turkeyen as one of the most important matters connected with the cultivation of estates in British Guiana. Henceforth, if any man complain of his estate suffering from defective drainage, we shall look upon it as his own fault, for which he deserves to pay the penalty, as the cost of the engine and other works; and the erection, will amount to less than what, probably, would be required to be paid in labour wages for the purposes of drainage alone, in the course of one year, in addition to the consequent abstraction of labour from the cultivation of the estate.

THE THAMES TUNNEL.

Sir,—Little appears at present to be doing for the furtherance of the transmission of carriages, &c., in this gigantic undertaking, and I avail myself of your valuable publication, to make a suggestion which the genius of a Brunel might perhaps succeed in carrying out, and which would be attended by rather important results.

Having understood that the principle of the centrifugal railway is about to be employed in a tunnel under one of our great rivers, it occurs to me, that there is perhaps a sufficient fall in that of the Thames for carrying out the same plan; in such case, we may soon have the wonderful spectacle of an extended train of vehicles, horses, wagons laden with colonial produce, suddenly disappearing from the surface of the earth, plunging under the bed of a mighty river, and re-appearing on the other side, whilst reciprocating lines, teeming with the wealth of the rich neighbouring agricultural

counties, would almost instantaneously occupy their place; a result which would speedily shed its beneficial influence upon all connected with the undertaking.

I remain, Sir, your obedient servant,
R. H.

Southwood Lane, Highgate, Feb. 6, 1844.

THE THAMES STEAMERS. THE "SAPPHIRE," LATE "ATMOSPHERIC."

Sir,—Those of your readers who are in the habit of travelling on the Thames must be much surprised, if they have put much confidence in the assertions of "Veritas," to find that the "Sapphire," which he describes as a total failure, and as proving that atmospheric engines would never enable a boat to view any part of her rivals but *the stern*, should, now that it has been added to the fleet of the Diamond Company, and runs every day, instead of two or three times in a season, be capable of bringing them from Gravesend to Blackwall within some minutes less than the hour, and beating the fastest of the old boats by about a quarter of an hour in the journey. I will mention, for the benefit of those who do not happen to have seen her, that the *Sapphire* does not look so sharp and slight as the generality of the modern river boats (I should have thought her almost fitted for short sea voyages); there is no unpleasant vibration in her motion; and lastly, her pressure is very low, which will perhaps afford the greatest satisfaction to those who retain the old-fashioned, and perhaps unjust prejudice, against high pressure steam, which is employed in the only rivals which can compete with her in speed, the *Isle of Thanet* and *Prince of Wales*.

Before I conclude, Mr. Editor, as I consider that the causes upon which speed depends are of more importance than the speed of any particular boat, I will state that, in my opinion, the great advances which have been made of late years are owing to the boats being made of iron instead of wood—being much longer—having the largest section towards the stern, instead of the bows—to their being furnished with direct-action instead of beam-engines—worked with high-pressure steam, expanded and condensed—and with tubular boilers.

Whether any of these changes involve inconveniences that the additional speed does not compensate for, must be determined by the public, and not by

Your very obedient servant,
CURVE.

THE "ISLE OF THANET" AND "MAGICIAN."

Sir,—From some cause the speed of the *Isle of Thanet* is very variable; and unfortunately when she does come in competition with another fast steamer, she is seldom in racing trim. I think, however, I can relate (which I have no doubt Mr. Napier will acknowledge in an early Number) the hardest struggle she has had since she has been a vessel. I forget the precise date; but suffice it to say, that the last day the *Thanet* was on the station, in the latter part of the year 1842, the *Magician* waited for her off Ramsgate; they raced to Margate, and certainly the result was in favour of the *Magician*. The *Thanet* then went into Margate, and the *Magician* waited till the other again came alongside, when they went neck and neck together nearly to the Nore, the engine of the *Thanet* never making less than 44 revolutions. The *Thanet*, however, increased the engine speed to 46 turns, when she certainly slightly left the *Magician*. The latter vessel having to put into Gravesend for coals, made it impossible to ascertain the number of minutes she would have lost.

I think I may safely state that the *Magician* is the only vessel that has held way with the *Thanet* when her engine has been going 44 revolutions.

I think it has been asked, "What has become of the *Magician?*" The General Steam Navigation Company have bought her, and it is supposed she is *too fast* for *them;* therefore they have laid her up to rust in their tier at Deptford.

I am, Sir, your constant reader,
JOHN MATTHEW.

Battersea, March 7, 1844.

THE AMERICAN STEAM FRIGATE "PRINCETON"—FURTHER PARTICULARS, FROM THE "NEW YORK HERALD."

The new steam frigate *Princeton*, with Ericsson's transversal screw propeller, was exhibited yesterday, by R. F. Stockton, Esq., her gallant commander, to the members of the press, engineers, captains, &c., of New York. It is one of the most extraordinary and successful exhibitions of steam machinery we ever remember to have seen. * * * The steam frigate seems to be perfect. The principle of steam propulsion introduced in her must in a short time drive the old-fashioned, wind-resisting, uncouth paddle houses out of existence. This is proved in a variety of ways, but a *coup d'œil* is sufficient evidence. In her, we see a vessel of about seven hundred tons burden, with an engine of two hundred and fifty horse power, working a single submerged propeller, running out at her stern, capable of making thirty six or seven revolutions a minute, and sending the ship through the water at the rate of fourteen miles or more per hour. So far only two-thirds of her

power have been used, and with that she has beaten the *Great Western*, the crack steamer of the Atlantic, called, for her speed, the Fashion of the Ocean. This was done when the *Princeton* drew four feet more water than the *Western* did. This tested her speed, and it is said with confidence that she can beat any steamer in the world.

In active service, steamers like the *Princeton*, fitted up with the submerged screw, have great advantage over every other kind of vessel. Wheels, boilers, machinery, furnaces, cranks, &c., are all below water line —the top of the highest plate of the boilers being four feet below that mark. No ball can, therefore, come within that distance of any part of her machinery. In the *Great Western*, and in all other steam ships and frigates, the wheels, smoke pipes, boilers, and indeed every part of the whole, is exposed to the shots from the enemy's guns. And in the *Princeton* there is another desideratum, namely, that of burning anthracite coal in three furnaces, from which no smoke issues, so that a stranger cannot tell by what means she is propelled.

But this is not all. This beautiful vessel is ship rigged, and when a fair wind is blowing, the screw can be unshipped, canvass spread, and she will then "walk away" from almost any ship afloat. The propeller offers scarcely any resistance, and the *Princeton* has already freely run off before the wind faster than many vessels have in these days.

So much for the *Princeton per se*. In connexion with her, however, there are the two monsters on her upper deck that deserve attention; they are of wrought iron, and of beautiful workmanship. One is 13 feet long, and the other 16 feet. They have a bore of 12 inches in diameter, and carry a ball of 250 pounds weight with the accuracy of a rifle. It is said that Captain Stockton can "snuff a candle" at three miles distance with either of them. They are his playthings. As a means of destruction they have never been equalled, not even by the great gun of Mehemet II.

In this successful application of a new and important principle in steam navigation, the public cannot rejoice too much. It is in this case clearly demonstrated that the submerged screw must inevitably shut up all other mode of propulsion. In warfare, the value of it is at once apparent, and in the merchant service it is of equal use and importance. Its machinery is so compact, and its consumption of fuel, by taking advantage of favourable winds, is comparatively so small, that the world will in a few years be astonished that the principle had never before been introduced. It is now coming into general use in America, and there are already fifty-six vessels on our rivers and canals that are propelled by the screw. There are also at least a dozen vessels now building on the same principle, which will go into service early next spring. Several of these are to run between Boston and Troy; others are to go south. These vessels every day strengthen public opinion in their favour, and the successful application of the screw to the *Princeton*, which is to be more fuly tested this winter by keeping her upon our coast in the worst weather, will satisfy every mind of its value and importance, not only to the military, but to the mercantile marine of the world.

The Undocking of the "Great Britain."—Proposed to be effected by concentrated electro-magnetism.—[To the Editor of the "Bristol Mirror."]—Sir,—Hearing of the difficulty of getting the great iron steam-vessel through the Dock Gates, and the various proposals made by engineers in order to effect her transit, I will, by your permission, lay before the public the following observations with regard to a discovery, the ultimate effect of which, employed as a mechanical power, &c., I think it will be impossible to calculate. When considering how large a quantity of electricity a small vessel, a Leyden jar for instance, can be made to contain, the idea would often arise in my mind, is it impossible that the magnetic influence (electro-magnetism) may be collected and condensed in a similar manner? After ruminating on this subject for a considerable time, I commenced a series of experiments, conducted, I admit, at first very much at random; but after many years of trial and disappointment, and after repeatedly dropping the scheme as altogether chimerical, I may at last venture to say with confidence I have succeeded in concentrating electro-magnetic fluid, and thus forming an artificial magnet of incredible power. My condensed magnet, for such I propose to call it, is, in proportion to its power, of a very small bulk; and with a very small instrument, I have bent a lamp-post, by fixing the magnet on the other side of the street. I believe my invention could be made quite available in relieving the *Great Britain* from her present embarrassing position. I am informed she will require two feet elevation to enable her to pass through the Dock Gates, and I propose to effect this elevation by magnetic attraction. A row of strong machines, capable of bearing the necessary weight, which weight might be easily calculated by the quantity of water displaced by the vessel, are to be erected over the lock. I do not make any pretence to engineering science, but presume this could be done without great difficulty; and into the apices of these machines condensed magnets, of sufficient power to give the vessel the necessary elevation, are to be firmly fixed; by these means she would be partly lifted and partly floated cut of the dock. With regard to the possibility of this proposal, and the fact of my discovery of the concentrated electro-magnetism, it is my intention shortly to exhibit the magnets in full operation, either at the Polytechnic or other suitable building, when I will, by their means, suspend a cube of iron, three feet square, like the coffin of Mahomet, between earth and heaven. I am, Sir, your obedient servant, THOMAS EDMONSON.—Rutland Villa, Montpelier, March 6, 1844.

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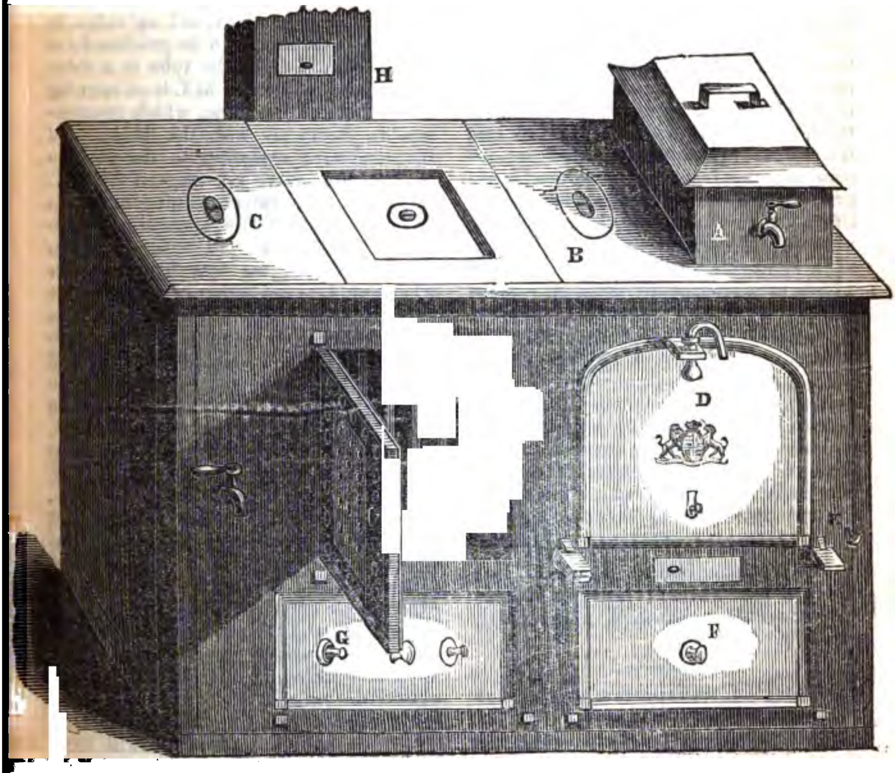
Edited by J. C. Robertson, No. 166, Fleet-street.

DEANE, DRAY, AND DEANE'S COOKING APPARATUS.



The variety of articles of this kind devised of late years, seems almost to preclude the possibility of any considerable novelty. The enormous cooking ranges of our portly ancestors, had few properties in common with the convenient, compact, and almost elegant structures which have succeeded them. In the former, the grand operations of roasting and boiling were effected, as we may say, by main force of heat, without contrivance, adjustment, or economy; in the latter, all the operations required by the most refined *cuisine* are effected by one fire, at little cost, and with extraordinary convenience.

The cooking apparatus of which our front page presents an engraving, is chiefly remarkable for improvements in the details of its contrivance. Including its boiler, it is composed almost entirely of wrought iron, by which the danger of fracture from unequal expansion by heat is avoided. The only parts made of cast iron are the front bars and the bottom grate, which are so made as to be easily lifted out, and cheaply replaced when worn out. The upper surface is composed of three loose wrought iron plates, any of which may be instantly lifted off when it is necessary to gain access to the interior. And, finally, the whole is so contrived as to stand in any convenient place without the aid of brick-work or a chimney, requiring only a common pipe like that of a stove. We consider the union of these desirable properties and conveniences an advance worthy the attention of those of our readers who may feel an interest in this important article of household gear.

Description of the Engraving.

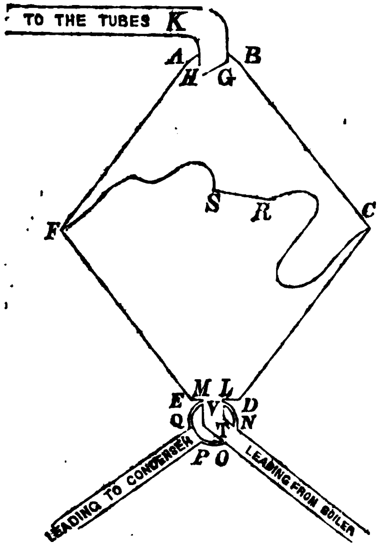
A is a copper boiler; B a hot plate; C top of steam boiler; D oven; E damper for regulating draught; F hot closet; G ash-pit; H flue.

PLAN FOR AN EXHAUSTING ENGINE FOR THE ATMOSPHERIC RAILWAY.

Sir,—Some time ago the following plan for the exhausting engine of the atmospheric railway occurred to me, which appears to me to have some degree of plausibility. I believe that at present the vacuum is produced by an ordinary low-pressure pumping engine; that is to say, the vacuum produced in one vessel (the cylinder) by the condensation of steam, is made, through the medium of machinery, complicated, extensive, and working with a great deal of friction, to produce a vacuum in another vessel. As great part of the first cost, expense of repairs and waste of power, would be avoided if the vacuum produced by the condensation of steam could be used *immediately* to produce the required vacuum in the tubes, to effect this was a problem I proposed to myself, and the solution which occurred to me is represented in the accompanying figure.

A B C D E F is a hollow double truncated cone of sheet iron, terminated by two circular ends, A B and C D; K is a tube leading to the vessel or tubes in which the vacuum is to be produced; at the mouth, H G, of the tube is a valve opening into the cone. M L is an opening at the base of the cone, which communicates alternately with the boiler and the condenser according to the position of a sliding valve represented by V T. At A and B are valves opening outwards from the cone. The apparatus represented by C R S F, will be described in the sequel; but we may first consider what would be the action of the machine as already described, if the valve V T is made alternately to open the communication with the boiler and shut that with the condenser, and *vice versa*. In the first position, the steam rushes in from the boiler, the valve G H shuts, and the air in the cone is driven out through the valves at A and B. If when the cone is full of steam, the communication with the boiler is shut, and that with the condenser is opened, the steam in the cone is condensed, the valves at A and B shut, and prevent the external air entering, while the valve at H G opens, and the air from the tube K rushes in to supply the vacuum. This mode of working is open to the obvious objection, that as the steam cannot drive the air out of the cone without mixing with it, a great deal of steam will have escaped before the whole air is expelled, and when the steam is condensed, a quantity of air will find its way into the condenser. To prevent the intermixture is the object of the apparatus C R S F. This consists of a flexible air-tight sheet, of the same shape and size as the interior of either

half of the double cone: it is attached to them at their common base C F, and it is terminated at the smaller end by a heavy circular plate of the same size as the circular ends A B and E D of the double cone. The way in which this is intended to act, will, I think, be evident



from the figure without much explanation. When the engine is not working, the weight of the plate S R will make it take a position immediately above E D. If now the process before described is repeated, and the communication with the boiler opened, the stream rushing in under the flexible sheet raises it up in the manner shown in the figure till the point S reaches A, and the point R reaches B; the air is thus expelled without any steam mixing with it and escaping; and when the communication with the boiler is shut, and that with the condenser opened, the whole steam in the cone is condensed without any air, except that contained in t : steam itself entering the condenser. I is to be observed, that the sole office o the flexible sheet is to prevent the intermixture of the air and the steam, that it has no strain to bear, and that probably a very slight material, if air-tight, would a swer the purpose. The machine may b considered as analogous to an atmos pheric engine used to pump air without a beam, with this difference, that the c inder, with the piston sliding up and d wn, and the cylinder piston of the pump, are replaced by the cone and the flexible sheet blown alternately upwards and downwards without sliding or friction.

In the machine which I have described two important points are not provided for, viz. the working of the valve V T, and an air-pump for the condenser. Perhaps for these purposes a small steam engine might be necessary; perhaps the weight R S might be made to move the valve, and if the station is (as stations always should be, both for stopping and starting) at the top of a rise, a supply of water and a fall of 33 feet would enable us to exhaust the condenser without a pump.

Your obedient servant,

A. S.

Lincolns'-inn, March 18, 1844.

PREVENTION OF DEPOSITS IN BOILERS.

Sir,—I notice a communication from Mr. W. Hall in your 1074th Number, dated Lyons, February 12, 1844, wherein he recommends common salt (muriate of soda) as a remedy for the incrustation in steam boilers; and states, that he has employed it successfully for five years and upwards. Now, really, I must be excused in saying, that Mr. Hall must surely have been dreaming, or he could not have made such a ridiculous assertion; the *rationale* he gives of its action is, in the first place, diametrically opposed to all chemical fact, for the sulphate of soda *decomposes the muriate of lime*, precipitating the lime as a sulphate, instead of, as he states, the muriate of soda decomposing the sulphate and carbonate of lime, rendering them soluble as muriates; and, in the second place, *marine* boilers are as subject to incrustation as land boilers, not from a deposition of salt, when ordinary care is taken, but principally arising from a scale of sulphate of lime forming, which scale is of a most compact and adhesive character, occasioning, from its non-conducting power, such a waste of fuel and destruction of plates, that in these days of manufacturing economy and improvement, it is really surprising with what apathy, or ignorance, the loss is viewed; seemingly, as if it were considered one of those natural occurrences which defied human intellect.

I am, &c. &c.

F. HAM.

Norwich, March 18, 1844.

ON THE NUMERICAL SOLUTION OF EQUATIONS, PART III.—APPROXIMATION TO IRRATIONAL ROOTS.

Sir,—I am, in the present paper, to show the application of Horner's method of solving equations to the finding of irrational roots.

In the equations solved in the previous papers we succeeded in every case in *exhausting* the last co-efficient by repeated subtractions, and we justly inferred, that when this was done a root of the equation was attained. But those equations were intentionally formed so, that the result referred to should arise. In other words, being formed with *rational roots*, the exhaustion in question was a necessary consequence of this formation. Now in equations formed at random, or in such as would most likely occur in practice, it is but seldom that we should succeed in bringing the operation to such a satisfactory conclusion. And this would arise, not from any defect in the method of solution, but simply because the proposed conditions could not be fulfilled by rational numbers. For example: to take a simple instance, let it be required to find the square root of 12, or to solve the equation $x^2 - 12 = 0$. We see at once, that since 12 lies between 3^2 and 4^2, its square root must lie between 3 and 4, and hence that this root cannot be a whole number. But neither can it be a rational fractional number, for every such number multiplied by itself produces a similar number. Hence we conclude, that it must be an irrational number, that is, a number which cannot be expressed in finite terms. Consequently, in seeking to solve an equation, a root of which is an irrational number, the operation will never terminate; we shall never succeed in exhausting the last co-efficient. As the operation is continued, however, we produce numbers which more and more nearly fulfil the proposed conditions, insomuch that, if any magnitude, however small, be assigned, which the error of our result must not exceed, we can find a result which shall be true within the proposed limit.

Example 1. Required the cube root of 2, true to the nearest unit in the 25th decimal place.

The solution is on the opposite page, and I proceed to give such explanation of it as seems necessary. The operation, down to the first thick line in the 2nd and 3rd columns, and the first comma in the root, needs little remark. It is precisely the same as that exhibited in the last paper, except that here, the last co-efficient being *used up* in the first involution, cyphers are annexed to form the succeeding periods, the decimal point being placed in the root on the annexation of the first period of cyphers. I may also notice, that as it is found, on the completion of the 7th involution, that the number 476, &c., in the 2nd column, is not contained in 237, &c., the number in the 3rd, a cypher is placed in the root, and another period annexed to each of the columns.

Now it is a general principle in all such extractions that, whatever number of root figures may have been found by the complete process, that number may be doubled by simple division.* So, having here found 10 figures, if 20 were all we wanted, we should find the remaining 10 by simply dividing 426, &c., by 476, &c. But we want 16 figures more, at least, and as division will give only 10 correct, we have recourse to an abbreviation of the complete process, which is thus described: Instead of adding cyphers to the numbers at the bottom of the several columns to prepare for a new involution, let the number in the last column remain unaltered; strike off one figure from that in the next to the last, two figures from that in the second from the last, and so on to the first column, which is occupied by the first co-efficient. The effect of this is, that when the first co-efficient consists of fewer places than have to be struck off from the column it occupies, (as it always does in simple extractions, being then unity,) it disappears at the first step. The first working column consequently receives no farther increase, and the operation is in fact reduced to that of the solution of an equation of the next lower degree. Involve with the numbers thus diminished, taking due account of the carriage from the figures cut off, as in contracted multiplication and division, and on the completion of this involution curtail the numbers attained as before. By repetition of this process the columns

* This principle is not peculiar to Horner's method, but applies to the old method as well.

Extraction of the Cube Root of 2.

1	1	2(1·259921049,894873,16476721061
2	2	1
30	300	1000
32	64	728
	364	272000
34	68	225125
360	43200	46875000
365	1825	42491979
	45025	4383021000
370	1850	4282778799
3750	4687500	100242201000
3759	33831	95242392488
	4721331	4999808512000
3768	33912	4762198998961
37770	475524300	237609513039000000
37779	340011	190488117196540864
	475864311	47121395842459136000
37788	340092	42859828036097216649
377970	47620440300	4261567806361919351
377972	755944	3809762521730873376
	47621196244	451805284631045975
377974	755948	428598283997482281
3779760	4762195219200	23207000633563694
3779761	3779761	19048812623531516
	4762198998961	4158188010032178
3779762	3779762	3809762524720816
377976300	47622027787230000	348425485311362
377976304	1511905216	333354220913294
	47622029299136216	15071264398068
377976308	1511905232	14286609467712
3779763120	4762203081104044800	784654930356
3779763129	34017868161	476220315590
	4762203115121912961	308434614766
3779763138	34017868242	285732189354
3779763147	4762203149139781203	22702425412
—	302381052—	19048812624
	476220315216359172	3653612788
	302381052	3333542209
37797631	476220315518740224	320070579
—	3401787—	285732189
	47622031555275809	34338390
	3401787	33335422
377976	47622031558677596	1002968
—	15119—	952441
	4762203155882879	50627
	15119	47622
3779	4762203155897998	2905
—	302—	2857
	476220315590102	48
	302	48
37	476220315590404	—
—	2—	
	47622031559042	
	2	
	47622031559044	

on the left will disappear, one after another, till only the last two remain, when the process is legitimately reduced to contracted division, in which one figure is cut off from the divisor at each step. In the example before us, the first 10 figures of the root are found, as already intimated, by the complete process; the next 6 figures, to the second comma, are found by the abbreviated process, and the remaining 11 figures, the last one of which alone cannot be depended on, by contracted division. The contracted division commences after the second thick line in the last column, and the divisor is the number at the bottom of the preceding column.* I may remark that this root is, so far as it goes, an arithmetical solution of the famous ancient problem of the duplication of the cube; that is, it is the side of a cube whose solid contents are double those of a similar figure whose side is unity.

Example 2. Required the square root of 2.

The solution of this example, which gives the ratio of the diagonal of a square to its side, is in the next column. Here, as there are only two working columns, and the first co-efficient consists of but a single digit, the operation changes at once into contracted division, when half the number of root figures is found. And the last figure alone is not to be depended upon, although I believe it is perfectly correct.

Example 3. Required a value of x in the equation,

$$2x^4 - 3x^3 + 6x - 8 = 0.$$

This equation, which, to avoid the labour of verification, I have formed so that a root of it should be the square root of 2, differs from those previously solved in that its first co-efficient is 2, the term in x^2 is wanting, and it has no rational root. A comparison of the root found, (page 199) with the square root of 2 found in last example, shows that there is a deviation from the truth of a unit in the last figure. Six figures are found by the complete process, six more by the abbreviated process, and the remaining ten by contracted division. Had the complete process been carried one step farther we should have had four more figures correct in the result.

* I have, for convenience of printing, marked the figures cut off by lines underneath them; but in practice the pen may be drawn through them.

It was asserted by De Lagny,* a French mathematician of the 17th century, that by the method then and still in use, the most expert arithmetician could not, in the space of a month, extract a cube root consisting of 9 figures! I should say that the time requisite for the performance of the specified operation is here vastly over-stated. Nevertheless, if we

Extraction of the Square Root of 2.

0	2(1·41421356237,30950488018
1	1
20	100
24	96
280	400
281	281
2820	11900
2824	11296
28280	60400
28282	56564
282840	383600
282841	282841
2828420	10075900
2828423	8485269
28284260	159063100
28284265	141421325
282842700	1764177500
282842706	1697056236
2828427120	6712126400
2828427122	5656854244
28284271240	1055272215600
28284271243	84852813729
282842712460	2067440187100
282842712467	1979898987269
282842712474	87541199831
	84852813742
	2688386089
	2545584412
	142801677
	141421356
	1380321
	1131371
	248950
	226274
	22676
	22627
	49
	28
	21
	22

* See that strange book of Mr. Baron Maseres, a collection of Mathematical Tracts, commencing with what is called a *translation* of Bernoulli's Doctrine of Permutations and Combinations, page 484; also the Companion to the Almanac for 1844, pp. 5 and 13.

Solution of the Equation, $2x^4 - 3x^3 + 6x - 8 = 0$.

First co-efficient, 2.

−3	+0	+6	+8(1·41421,356237,3095048803
2	−1	−1	5
−1	−1	5	30000
2	1	0	28512
1	0	5000	14880000
3	3	2128	10422022
50	300	7128	44579780000
58	232	3184	42310677632
	532	10312000	22691028680000
66	264	110022	21249714469792
	796	10422022	14413092102080000
74	296	110846	10627223968532162
820	109200	10532868000	3785868133547838
822	822	44801408	3188211151090134
	110022	10577669408	597656982457704
824	824	44934144	531370497789235
	110846	10622603552000	66286484668469
826	826	2253682896	63764497608876
8280	11167200	10624857234896	2521987059593
8288	33152	2254015408	2125483393402
	11200352	10627111250304000	396503666191
8296	33184	112718228162	318822509787
	11233536	10627223968532162	77681156404
8304	33216	112719059526	74391918979
83120	1126675200	10627336687591688	3289237425
83124	166248	3381604209 -	3188225099
	1126841448	1062737050363378	101012326
83128	166256	3381611691	95646753
	1127007704	1062740431975069	5365573
83132	166264	56360340—	5318708
831360	112717396800	106274099557847	51865
831362	831362	56360360	42510
	112718228162	106274155918207	9355
831364	831364	676325—	8502
	112719059526	10627416268146	853
831366	831366	676325	850
831368	112719890892	10627416944471	3
—	2494—	2254—	3
	1127201403	1062741696701	
	2494	2254	
	1127203897	1062741698955	
	2494	34—	
831	1127206391	106274169929	
—	4—	34	
	11272068	106274169963	
	4	1—	
	11272072	10627416997	
	4	1	
	11272076	10627416998	

ll the time a week, or even a day, the nmeasurable superiority of Horner's ethod will still be sufficiently apparent.

The time occupied in the solution and verification of the first of the foregoing examples, being the extraction of a cube

root of 27 figures, was somewhat less than two hours; and that occupied in the solution of the third, being the extraction of a 4th root of 22 figures, was rather less than one hour. What would De Lagny have said to this!

I have still, Mr. Editor, a few remarks to offer on the rationale of this method, and an extension of it to suggest which, I believe, has not hitherto been pointed out. If I might venture once more to trespass on your columns for these purposes, I think I can promise that the paper shall be a short one. At all events, it shall certainly be the last.

I am, Sir, yours respectfully,

G.

Hermes-street, Pentonville, March 9, 1844.

IMPROVED PARASOL—MESSRS. WADDINGTON, HORTON AND CO., OF LONDON WALL, PROPRIETORS.

[Registered under the Act for the Protection of Articles of Utility.]

Fig. 1.

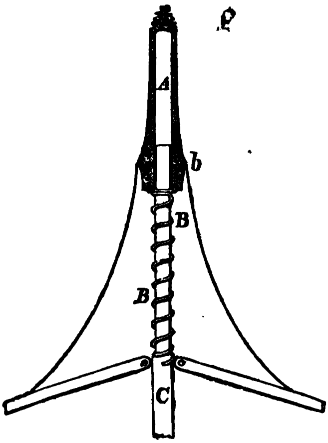
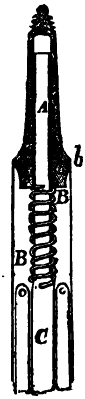


Fig. 2.



The improvement in this parasol consists in so constructing it, that on opening and shutting the parasol, that part of the stick between the silk and the ferrule shall not be seen, which Messrs. Waddington and Co. have very ingeniously effected. We take the following from the inventors' description:—

Description.

"Figs. 1 and 2 are views, partly in section, of so much of the frame-work as is necessary to show the improvement now registered. A is the top of the parasol; and *b*, the ring to which the gores of the cover are attached at top; the top and ring being in one piece. The top A, instead of being solid, as usual, is hollow. B is a spiral spring, which surrounds the upper end of the stick C, from the point where the ribs are attached to it, being made fast at bottom to the stick, and left free at top to move up and down according as it is pressed upon by the top A. When the parasol is drawn down the gores bring down with them the top of the parasol, which, compressing the spiral spring, allows the upper end of the stick to pass up into the hollow recess in the parasol top. Fig 1 shows the relative position of the parts A *b*, B and C, when the parasol is expanded, and fig. 2 the same when the parasol is drawn down.

The parts of this design, which are not new or original, are all the parts, excepting as is hereinafter excepted. The part which is registered as new, in respect of the form and configuration thereof, is the top A, by making which hollow, and of greater diameter than usual, the upper end of the stick C is enabled to pass up into it when the parasol is drawn down; which, also considerably shortens the parasol when shut down, and when open greatly improves the whole appearance."

FATAL BOILER EXPLOSION AT BRADFORD.

On the morning of Saturday 9th inst., the steam boiler of a spinning mill, called Mason's Mill, in Bradford, exploded just as the work of the factory was about commencing, by which we lament to say, six persons were killed and one severely wounded. From the evidence given at the inquest, which was subsequently held on the dead bodies, we derive the following information respecting the causes of this melancholy accident.

Mr. Edward Clegg, the manager of the mill: "I don't know the cause of the explosion. Usually, before that morning, when the steam was too high, there was a boiling over at the feed pipe, but that morning it did not boil over. I don't know that that boiler had been subjected to any greater pressure of steam, or that there had been any additional pressure on the valve. The engine tenter had the entire management of that. I don't know that he had any means of putting water into the boiler without taking off the man-hole lid. I have seen the feed pipes boil over once or twice a week when the other boiler was attached; (see afterwards as to this second boiler); it has boiled over twice a day; when the engine was running I have seen the engine-tenter hold down the valve to stop it from boiling over. I don't know how long the boiler had been in use; but it commenced this time in July last; it had been standing some time before. It had been doing the work of two boilers more than three weeks.

By the Jury: The engine was hardly as well run before the removal of the other boiler as after; sometimes the engine was at 17 strokes and sometimes at 20; that was our given speed then; but we made some alteration of the speed pulleys, and it was to run at 21½. We seldom run at 21½ with the two, but I don't know how that was. I had found fault with the engine-tenter before, because he did not keep up to the speed. I found more fault before the removal of the boiler than after. He used to excuse himself when he had both boilers running and I found fault, by saying that he was running as well as he could. When he had only one, and I had to find fault, he said he could not keep up the steam, he had his fires to clean so frequently.

By the Coroner: I was surprised that he ran the engine better with one than two boilers. I never saw the feed-pipe valve tied: I never had an opportunity of seeing the safety valve.

Mr. Hattersley (one of the Jury) said, the engine was one of only sixteen horses power, and the boilers were each of thirty horses power, so that there was nothing extraordinary in one of the boilers working the engine as well as two.

By the Coroner: The engine-tenter was a sober, steady man. I never heard my master find fault with him, except when we did not run at the proper speed before the boiler was taken away.

John Milner, the engine tenter—I went to the mill at half-past five on Saturday morning. I looked into the fire holes under the boiler, and saw the fire had been stirred up by the watchman before he went off, and it was very low. I spread it over the grate, and threw a few coals on and shut the doors, and then I lighted the lamp, and went on the top of the boiler, and the steam was just beginning to come out of the safety valve. *I shut the valve and went down, and fired up about other three times.* Then I waited a little till the fire burnt up, and then I went and oiled the engine. It was about 6 o'clock when I had done, and I went into the low room to see what time it was by Clegg's watch, and it was 5 or 6 minutes past by it. I staid until it was between seven and eight minutes past, and I had just turned my back of him to go and set the engine on, and something gave a crash same as thunder almost, and before we could speak to one another the glass of the room came in, and the roof fell in at the same time. We have had a good deal of trouble with the engine. I have been an engine tenter three or four years. I was not a mechanic before. I have not had the feed pipe valve tied down. I always kept the weight on the safety valve the same. I eased the weight about two nicks after the old boiler was removed. I always draw the throttle valve every night. I did not put any extra weight on the boiler valve. We had not a steam gauge up, for on taking the old boiler they had taken it down too. It was attached to the safety valve; it was removed because it was in the way. I had no opportunity of knowing at what height my steam was, except by the safety valve. I just kept at the point of boiling over. The safety valve lever is about 10 inch long, but I can't say how many notches it has in it, or how far they are asunder. Helliwell is the engineer; he had never directed me as to where the weight was to be hung on the safety valve lever. I hung it so as to keep the valve nice and easy. I never had the feed pipe valve tied down except when it boiled over. I never left it a whole night down. The water gauge in the boiler was all right at half-past five.

It was a float, and a chain came over a wheel. The weight was on the boiler. It was my first job to examine that every morning. If it had not been right, I could not have poured cold water into the boiler without taking the man-hole lid off. We had a cistern containing about seven tons of water, kept to clean the boiler out. It was a yard and a half up, and we had no pipe down from the cistern to the boiler, and when we wanted to clean the boiler out, we had to let the water in by means of spouts. When I went up to the safety valve I did not put it out of order. *I always fastened the safety valve up at night to allow the steam to escape.* The safety valve would allow the steam to escape before a boil over would take place; for when I have had a boil over at the feed pipe there has always been an escape at the safety valve also. I can't say how many boils over we have had in a day, not three regular; but we have had three in a day sometimes. We had more boils over with the two boilers than the one.

The CORONER: What was the cause of the accident?—I can't say what has been the cause. I had no idea that it was going to happen. I had only just been away a few minutes, and was coming back into the engine house, and it happened. I don't know anything, without the boiler seat had given way, and the boiler had tumbled over. The boiler had stood nearly four years with water in it, and when we took away the old boiler, all the bricks of the seat were nearly mouldered away.

By the Jury: The feed pipes were eighteen or twenty feet from the top of the boiler. I had not observed the boiler seat give way. I can't say that it was disturbed with removing the other.

Mr. CHARLES TETLY, stuff merchant, deposed, that he got down to the mill about half past ten o'clock on Saturday morning, in company with Mr. Crossland. He saw and examined the safety valve, which he found lying near the boiler, covered with rubbish; the spindle was *perfectly straight*, and the valve open. There was a piece of string on the valve spindle at the end, and on the outside of the valve box. It was not tied, but twisted, and evidently had been so for some time, as when he unwrapped it, it retained its coil. He could not speak as to the use to which it had been applied, but from its appearance he was decidedly of opinion that it had not tied the valve at the time of the explosion. He also saw the rod to which the float of the water gauge had been attached. The hook to which the weight had been attached was worn to the thickness of a shilling, and he thought so much that it would not be able to sustain the weight, and consequently it had dropped off. It was perfectly straight at the end. He remarked the lower edge of the stay lugs inside the boiler had been cut by the pins, which he supposed had been done while the lugs were at a red heat. He did not see any stays at the bottom of the boiler. He examined the hot well, and found it only half full of water; he also asked if there were any valves between the force pump and the engine, and was informed there were not, so that the pump might actually be working and not pouring water into the engine. He only saw one float rod in connexion with the boiler.

Mr. ILLINGWORTH (one of the Jury) said there would be two float rods. It was not necessary to have the pump-valves which Mr. Tetley spoke of, and the string he had described appeared to have been the one which opened the safety valve at night. If there had not been a weight to the float, the balance would have been carried past the centre, and the weight outside would have gone down.

Mr. HATTERSLEY said, if Mr. Tetley's opinion as to the float rod having lost its weight were correct, there would have been a crooked portion of the hook left.

Mr. E. J. MITCHELL, agent for Mrs. Broadbent, the proprietor of the mill, stated that he always thought the engine man a steady servant. He was not aware that the steam gauge had not been fixed up again. The boiler was five years old, and had been worked two. The other boiler had been taken away because it was bad, and a new one was within a week of being completed, to take its place.

The Verdict.—The said jurors on their oaths do say, that the said John Wilman, on the ninth day of March aforesaid, at Bradford, in the parish aforesaid, was then and there standing in a boiler house, wherein was fixed the boiler of a steam-engine, containing a large quantity of boiling water and steam arising therefrom, when accidentally, casually, and by misfortune, the said boiler burst and became disrupt, and the boiling water and steam therefrom was thrown with great force and violence, upon and against the head and face of him, the said John Wilman, which were thereby so mortally bruised, scalded, and wounded, that he died thereof instantly.

Remarks on the Causes of the Accident— By a Bradford Correspondent.

"Some people think the cause to have arisen from a want of water, and that the flue plates being red hot, hydrogen gas was formed. On examination, this did not ap-

pear to have been so, for along with their general appearance to the contrary, the calcareous deposit was *white* up to the water line; but if the plates had been red, this would also have been red. The engineer too maintains very stoutly that he had plenty of water in the boiler. It might, however, be some clue to this, or similar explosions, to have this question solved: If the safety valve is left open at night, and, through any cause whatever, hydrogen gas should be formed when the steam is got up—would then an explosion occur? In the engineer's evidence before the coroner he says, 'I always fastened the safety valve up at night to allow the steam to escape.' If so, the boiler in the morning would be full of cold air, and continue so after he had put the valve down. If then, during the process of firing up, and before the engine was set on, hydrogen gas was formed, air being present in the boiler, what would be the result? I do not say this was the cause of the present most lamentable accident, for the appearance of the rent metal and the evidence of the engineer would seem to gainsay such an inference. After all, both may be mistaken; for some cause commensurate with the effect must have been at work, and most certainly it was a tremendous one. If any of the numerous readers of your excellent Magazine can give any help in finding it out, it might serve to prevent similar catastrophes elsewhere."

THE "GREAT WESTERN" AND "GREAT BRITAIN" STEAMERS.

From the Annual Report made last week by the Directors of the *Great Western* Steam Ship Company to the proprietary, we glean the following interesting facts respecting these vessels.

The "Great Western."

The receipts of this vessel for 1843 have mounted to 33,406*l.* 0*s.* 4*d.*, and the expenditure has been only 25,573*l.* 4*s.* 3*d.*; the receipts for 1842 were only 30,830*l.* 8*s.* 2*d.*, and the expenditure 28,615*l.* 7*s.* 1*d.* To the improved state of things in the United States much of this is to be attributed; a good deal to a close attention to expenditure, but, the Directors believe, still more to the circumstance of Liverpool having been altogether the rendezvous for their business on this side the Atlantic. The result, as the accounts show, has been a saving in lighterage, boat-hire, and dock-dues, and the advantages of coaling, and transacting the shipping business in a floating dock, instead of being moored inconveniently seven miles from the place of business. The winter voyage by way of Madeira, terminated in a loss, principally arising from the misconduct of the pilot in New York harbour. Although the injury to the ship, through his wilful or ignorant conduct, was in itself but trifling and easily put to rights, the Directors felt called upon to make such representations to the authorities at New York as led to the suspension of the pilot. The conduct of Captain Hoskin in bringing the *Great Western* home after this event, for which he was not responsible, cannot be too highly estimated, and the Directors were glad to observe that it had been duly appreciated by the underwriters at Lloyd's. Under his command she has run nearly 240,000 miles at a higher average of speed than has been attained by any other sea-going steamer, 10½ miles per hour.

The old boilers have been replaced by tubular ones, at an expense of 3,000*l.*, by which the stowage is increased to the extent of 200 tons. New paddle-wheels are also in preparation.

The "Great Britain."

The Dock Company have not yet given their sanction to the passage of the *Great Britain* through the locks.

The Report refers to the experiments that have been made respecting the screw, and the Directors express their *regret* that it became necessary to put that for the *Great Britain* in hand before the experiments in the *Rattler* were concluded.

STATISTICS OF COTTON SPINNING IN FRANCE.

[From a communication to the *Manchester Guardian* by a practical man, who recently visited the principal seats of the French Cotton Manufacture, and has taken evidently great pains to obtain the most correct information on every point.]

The central marts of the cotton manufactures are Lille, Douai, and St. Quentin, for fine yarns, used in the bobbin-net and muslin trades; Rouen, and the department of the Seine, for coarse yarns, ginghams, and heavy goods; Alsace for the middle and best qualities of printing cloths. In the finest qualities of prints, especially, the Alsatians have the reputation, and to a certain extent deservedly, of superior taste in style and colouring. English designers for calico prints are progressing; but they hav

not yet attained the perfection so remarkable in the products of our neighbours.

Only yarns above 169's are allowed to be imported, and at a duty of 30 per cent.

In France, as elsewhere, the trade is subject to periods of ruinous crisis; demand ever fluctuating from the pressure of indirect causes, which escape calculation, and defy control. The years 1839 to 1842 inclusive, were times of prosperity and large profits. For the last fifteen months, there has been complete stagnation; and yarns have scarcely, if at all, realized cost price. The stock of yarns and goods has accumulated beyond all precedent, and is estimated, it is said, without exaggeration, at nine months' consumption; an enormous stock, indeed, for a non-exporting trade. This fact is important, and should be taken into consideration, when calculating the amount of raw cotton at present in Europe.

There are nearly 400 mills in France, containing upwards of four millions of spindles, and consuming 320,000 bags of cotton annually. The average quality of the cotton consumed in these factories is 1d. per pound better than is required in England for spinning the same counts. The French themselves attribute this to the superiority of our machinery and workpeople. Whatever may be the cause, it is certain that English spinners produce a better yarn from an inferior cotton.

There are comparatively few mills containing so many as 20,000 spindles. The average number will not exceed 10,000 spindles.

Machinery, gearing, and shafting are in general old, clumsy, and bad, especially in the mills about Rouen. Very good machinery is now made in Alsace from English models, but at thirty per cent. above the Manchester prices.

The import duty on machines going into France is 15 per cent., according to the French tariff; but, by a regulation recently adopted to silence the clamours of the machine-makers, machinery coming from England is surcharged with a fictitious value, by which means it is made to pay a duty of 25 to 30 per cent. This stupid policy cannot fail to be injurious to cotton spinning in France.

Two-thirds at least of the mills are worked by water power. In the neighbourhood of Rouen, for example, a mill, with a water-wheel attached, may be rented at rates varying from £15 to £40 per horse-power per annum, according to the distance from the city.

Coals, in the manufacturing districts, average 28s. per ton. This high price has led to the adoption in all the mills worked by steam-power, of Woolf's two-cylinder engine, with tubular boilers, which give an economy of fuel of 66 per cent. It is an astounding fact, but it is indisputable, that these engines and boilers give an equal quantity of power, with only *one-third* the quantity of coals consumed by many of the engines made in Lancashire. It will be believed with difficulty, that English engineers have overlooked so important an improvement; but ample experience proves beyond doubt that they have done so. In a list of prices of steam-engines, published in a foreign newspaper, by an English engineer of first-rate respectability, a 40 horses power double-cylinder engine, with tubular boilers, is guaranteed not to burn more than 140 lb. of good English coals per hour = 3½ lb. of coals per horse power per hour. Many of these engines are at work and fully satisfy the promised conditions. One in particular, made in London, and lately put to work at St. Quentin, is a *chef d'œuvre* of mechanical construction, superior to anything yet produced at Manchester. It is a 22 horses power engine, turns 4,000 doubling spindles, 4,000 revolutions per minute, and burns less than 60 lb. of coals per hour. When fully charged—and the doubling frames, being badly made, require great power—it will consume less than 3½ lb. of coals per horse power per hour. How many engines in this part of the country are consuming *five times as much*.

The mills in France make 84 working hours per week. There is a law, passed in 1822, for restricting the time of children labouring in factories; but it has been rendered a dead letter by the determined opposition of masters and workpeople.

The system of spinning most general in France for all counts up to 100's is—1st. Beaters and scutchers, ill-managed, staple-broken, and not half cleaned. 2nd. Carding engines, all flats, without licker-in, single or double carding, 14, 16, and sometimes as many as 20 engines, united by what is called a railway head, forming rolls of 5 lb. to 6lb. each, and put up at the drawing frames. 3rd. Drawing heads, with twelve single deliveries again united at a railway head: this operation is repeated twice or thrice. 4th and 5th. Slubbing and roving, with what is called "*roto frotteur*," or rubbing frame; a barbarous but economical machine. In these machines, the ends are rubbed or rolled into consistence between two cylinders covered with leather, having, besides the revolution in the direction of their axis, a quick reciprocating motion laterally. The effect of this machine is the same as that of Dyer's tube frame, over which it has some advantages of economy. With the very best man-

agement, it would always be a century behind the roving frame with differential movements. Slubbing and roving for fine counts are done by stretchers, which will, ere long, be superseded by the last-named roving frames. 6th. Throstles and mules. The former are not so general for spinning twist as in England. The objection to them is, "they take too much power." Of self-acting mules, there are not 15,000 spindles in France. Hand mules are small, compared with the *monster* mules of Lancashire; few of them have so many as 300 spindles. The average size will be about 240 spindles. There is a spinner and piecer *to each mule*, making three stretches per minute. Ten ounces of No. 30 per spindle per week of 84 working hours, is the maximum produce of a mill. The rest is lost in lifting, change of counts, &c. &c.

Wages vary much according to locality. Mills are scattered about the country in villages, for the sake of cheap labour and water power. The hands in these cases are of the most inferior description; whilst the economy of wages and water power is more than counterbalanced by general expense, and the many inconveniences of small separate establishments.

In a radius of thirty miles round Rouen, the average of wages in the mills will be nearly—

	s.	d.	
Boys and girls under 13 years of age	0	7	per day.
Girls and women above 13 years	0	11	,,
Piecers	0	10	,,
Card strippers, time-keepers, &c.......	2	0	,,
Mechanics	2	6	,,
Overlookers	4	0	,,
Book-keepers................................	6	0	,,

Mule spinners paid by the pound; average = five farthings per pound for No. 35 English, out of which they pay their piecers. The average earnings of a good mule spinner will be 16*s*. per week of 84 working hours.

A mill, twenty-four miles from Rouen, and requiring that distance of land carriage, taking the raw cotton and bringing back the spun yarn, lets for 350*l*. per annum, and is considered cheap. It is situated in a small village, and has a water wheel of 25 horses power. The occupier has 26 carding engines and 10,000 spindles, part mule and rt throstle. His produce is 6,000 lb. per ..ek of 28 counts. His expenses are—

..st of spinning	5 farthings per lb.	
..st of preparing.........	3 ,,	,,
..neral expenses	6 ,,	,,
	14 farthings, or $3\frac{1}{2}$ d. per lb.	

Waste 11 per cent.

The price of raw cotton in December last, ..hen these notes were written, was $7\frac{1}{2}$*d*. per ..ound.

Price of the yarn (which was nominal, for no sales could be effected) 13*d*. per pound; four months' credit, and 5 per cent. discount.

The crisis in the cotton trade in France still continues, with very little prospect of amendment. Fortunately for holders of large stocks of yarns, and there are many such, the rise in the raw material is a guarantee against serious loss.

SPECIFIC GRAVITY INSTRUMENTS.

Sir,—Perhaps it would be no disparagement to the other acquirements of men of science, if, before endeavouring to enlighten the world, they would first ascertain whether themselves or the public are most in the dark. A fine illustration of the need of this suggestion, is afforded by the proposal of "a new method of taking specific gravities" by Sir James Murray and his friend Dr. Jeffereys, as noticed in your No. 1066. Instruments on that principle are so very old, that it would be difficult to decide by whom they were first proposed. The *Pump-areometer*, exactly what Sir James recommends, has been long known. Then there are the *Litrameter* of Dr. Hare, and the *Syphon Hydrometer* of Mr. Meikle, described in the *Phil. Magazine* for September and October 1828.

I. K.

ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

Arthur Dunn, of Rotherhithe, in the County of Surrey, Soap-boiler, *for improvements in treating, purifying, and bleaching oils and fatty matters*. Patent sealed, March 28; Specification enrolled, September 28, 1843.

The improvements set forth by the patentee in his specification relate to a method of bleaching, and at the same time depriving oils and other fatty matters, of all unpleasant smell. The oil or fatty matter is put into a vessel, furnished with perforated pipes, or perforated shallow air receivers, placed at the bottom thereof. The vessel is heated by steam pipes, or by other suitable means, so as to keep its contents at a degree of heat varying from 170° to 230° Fahr. A stream of atmospheric air, at the ordinary temperature, is forced through the perforated air-pipes, or perforated chambers, by means of a blowing apparatus, which, as it passes up through the oil, or fluid fatty substance, is brought in contact therewith, and by its action the whole mass is purified; the time

occupied for completing the process varying according to the nature of the substance, and the degree of bleaching required. The vessel is covered with a hood which opens into a chimney, through which the air and other vapours are carried off, as they escape from the heated substance. This process, besides being useful in purifying, is described as being most effectual when employed for mixing any matter with oils or fatty substances, as they become quickly combined from the agitating effect produced by the air passing through them.

The claim is to the method above described of treating, purifying, and bleaching oils, and other fatty matters.

John Lucena Ross Kettle, of Upper Seymour-street, Portman-square, Esquire, and William Prosser, Jun., of Shaftsbury-terrace, Pimlico, Gentleman, *for improvements in the construction of roads, and in carriages to run thereon.* Patent sealed, May 16; Specification enrolled, November 16, 1843.

These improvements relate, *firstly*, to a mode of constructing roads with tram-ways of wood, combined with guide rails for the guiding of carriages thereon; and *secondly*, to modes of applying apparatus to carriages moving on tram-ways of wood, in order to guide carriages thereon. For carrying the first part of this invention into effect, the patentees prefer that the grain of the wood be laid in an upward direction in the construction of their rails, but this is not absolutely necessary, though they believe that it will be found that wood placed with the grain vertical, or inclining at an angle, will be found to wear longer than when the grain of the wood is in a horizontal direction. Another object of this invention is so to arrange tram-ways of wood in combination with a guide-rail, that the carriages used may run on wheels with plain tyres, and thus prevent the injurious effects which would result to wood rails from carriages having wheels with flanges. The guide rail is formed also of wood, and placed between the two others upon which the wheels of the carriages run, so that each line of rail consists of three rails, that in the middle being for the guide-wheel, the other wheels being without flanges. The guide-wheel is mounted upon the same axle with the others, and is furnished with a flange upon each side, which keeps the whole running upon the proper line. The second part of this invention also relates to another mode of guiding carriages which have wheels with plain tyres, when running on trams or ways of wood, and where no guide-rail is employed. It consists of a mode of constructing the carriages or frames of locomotive engines, by arranging guide-wheels in such a manner as to prevent the travelling wheels from running off the rails, and obviate the necessity of having flanges on the running wheels; and in the event of an accident arising from the axle of the running wheels breaking, the guide-wheels come into use as the running wheels, press upon the rails, and carry the carriage, which would otherwise fall to the ground. There are four of these guide-wheels attached to each carriage, placed in pairs, two before, and two behind; these are suspended within frame-work, attached to the carriage in such a manner that they may lie nearly at an angle of 45° with the horizon, their periphery being of a V form, the one side of which falls upon the upper side of the tram or rail, and the other against the edge. These guide-wheels may be made to press outward upon the rail, which is preferred; or they may, by being placed on the outside of the frame of the carriage, be made to press inward.

Claims. *Firstly*, the mode of constructing roads by combining tram-ways or surfaces of wood with guide-rails, in order that carriages with wheels having plain tyres may run thereon; and *secondly*, the mode of applying guide-wheels to carriages, as herein described.

Thomas Mitchell, of Dalton, Yorkshire, Dyer, *for a certain machine and apparatus for increasing, and permanently fastening the face, or gloss, of all kinds of woollen, worsted, and fancy cloths by the application of steam alone, without immersing the goods in water.*—Patent sealed, June 15; Specification enrolled, August 15, 1843.

Although only one machine is mentioned in the title of this patent, the specification describes and claims two distinct machines. One is an improved machine for *winding* such cloths as require *heat* for "fastening the face or gloss," from whatever source that heat may be derived; and the other is a machine for effecting that object by means of *steam*. The mere use of steam for finishing goods is not new, but the present patentee claims to have invented the application of it at a *high* pressure, to rolls of cloth, enclosed in a suitable vessel, and in such manner that the steam drives out before it all the atmospheric air which the vessel may contain. The steam usually employed by the patentee is of about 20 lbs. pressure on the square inch in the steam boiler.

Joseph Harvey, of James-street, Buckingham-gate, in the County of Middlesex, Gentleman, *for improvements in the construction of two-wheeled*

carriages. Patent sealed, July 20: Specification enrolled, December 20, 1843.

The improvements consist in so constructing two-wheeled close carriages, that the driver, though within a compartment of the carriage, may be separated from the three passengers, which a carriage fashioned according to this invention is intended to carry. The body of the carriage has windows in the front and at the sides, which may be varied, and such is also the case with the body of the carriage, provided the interior is so arranged as to carry three passengers, and a driver as aforesaid; and that the head of the driver, and the upper part of his person, may come above the top of the carriage, thus giving him a safe seat where he can have full power over his horse. The seats for the passengers are so arranged that two persons may sit with their faces towards the horse, the third passenger sitting on one side. The seats for the two passengers, with their faces towards the horse, are in the fore-part, an opening being left in the middle, for passing forward to reach the seat; that for the other passenger is on one side, and immediately at the back of one of the others; the other compartment is occupied by a box forming the under part of the driver's seat, the seat itself being in a line with the top of the carriage, and projecting a little backward over the same. The door for admitting the passengers is at the back, that for the driver is on one side, small steps being fixed to the body for facilitating his ascending thereto. In constructing the carriage care should be observed, that when the passengers and driver are in their places, the whole weight should be as nearly as may be in a state of balance upon the axle. From the above description it will be seen, that the novelty consists in the manner of constructing a two-wheeled close carriage, so that the driver, though within the carriage, is separated from the three passengers which the carriage is constructed to carry, and the passengers may communicate with the driver through a small door placed in the top for that purpose.

The claim is to the mode of constructing two-wheeled close carriages to carry three passengers, whereby the driver, though thin a compartment of the carriage, is parated or partitioned off from the passen-rs as above described.

David Napier, of York-road, Lam-th, in the County of Surrey, En-neer, *for improvements applicable to ilers, or apparatus for generating steam.* atent dated July 25, 1843; Specification rolled, January 25, 1844.

These improvements are intended to prevent what is technically called priming, or, in other words, to prevent water passing off from the boiler together with the steam. The surface of the water in the boiler is covered with one or more tiers of buoyant substances, such as hollow balls, or with substances that are not buoyant, supported in the interor of the boiler. The patentee does not confine himself to any particular shape or form of these substances, nor to any particular material of which they are composed, but prefers the spherical form; and where these substances can be supported conveniently on wire gratings, states that wood answers the purpose tolerably well. The effect produced by the balls is first to still the water so as to prevent it from rising up in quantities with the steam, and the upper tier of balls serves to intercept the smaller particles of water, and allow the steam to issue comparatively dry.

Claim.—The peculiar methods before described for preventing priming, of whatever form or material the substances employed are made, and whether buoyant, or supported in or on the water.

Richard Archibald Brooman, of the Patent Office, 166, Fleet-street, Gentleman, *for the manufacture of paper, cordage, matting, and other textile fabrics from certain vegetable substances not heretofore made use of for that purpose, as also for the application of the said materials to the stuffing of cushions and mattresses.* (Being a communication.) Patent dated August 10, 1844; Specification enrolled February 10, 1844.

The invention consists, *Firstly*, in manufacturing, in manner following, paper, cordage, matting, and other textile fabrics, from the convolvuli of the *cissus* genus or family of plants, which abound in the West India Islands, in English, French and Dutch Guiana, the Brazils, on the coast of Africa, and other parts, instead of, as usual, from linen or cotton rags. All the plants of this order may be used, but those known at Guadaloupe, vulgarly as *oua oua*, or *baba*, which is the *mimosa scandens* of Linnæus; the *guidandina bandue*, which is known at Guadaloupe by the name of *yeux à bourrique*, or *yeux à bœuf*, and the *ledum*, or marsh-bindweed, will be found most suitable.

The manner in which these vegetable matters are converted into paper is as follows. The stems are first stripped of the bark or rind, and then beaten or bruised till the fibres are separated from one another. The fibres are next dried, in order to extract the sap, and afterwards boiled for three or four hours with a suitable quantity

of American potash. They are next washed, and after that bleached by immersing them in hydrate of chlorine for three or four hours, or by any other approved means of bleaching. If a still greater degree of whiteness is desired than has been obtained by the preceding operation, the fibres are boiled with soda, then washed, and, lastly, steeped in water saturated with slack lime. The fibres, after being thus bleached or whitened to any desired degree, are carded by a metal comb, and then reduced to a pulp by pounding or beating. The pulp thus produced is to be afterwards manufactured into paper in the usual way, and it will be found at least equal to that obtained from linen or cotton rags, and it may be used, either by itself for the manufacture of paper, or in combination with rag pulp, or any other material suitable for the purpose.

The bark which has been stripped from the stems, as aforesaid, and which is of considerable thickness, may also be manufactured into paper pulp of a good quality by the same processes as before described, provided care is taken to detach from it in the first instance the epidermis or outer covering.

Another class of vegetable matters not heretofore made use of for the manufacture of paper, &c., but from which a good paper may be nevertheless made by the before-described processes, consists of the plants known in the West India Islands by the name of *herbes coupantes*, and also the bark of the West Indian pear tree, *poirier*, only these substances need not be subjected to the carding process by the metal comb before reducing them to pulp, but may be thrown into the boilers as they come to hand, together with a small quantity of soda or potash.

To make cordage, matting, and other textile fabrics, the plants, after being reduced to filaments as before described, must be first soaked and submitted to the same processes that hemp and flax undergo when used for similar purposes.

Secondly. The invention consists in applying the fibres of the plants aforesaid to the stuffing of cushions and mattresses. All that is necesssary for this purpose is to card the fibres after they have been treated in the same way as for the making of paper. No bleaching or decolouring process is requisite.

The claims are, *Firstly*, To the manufacturing in manner before described of paper, cordage, matting, and other textile fabrics from the several vegetable matters before specified. And, *Secondly*, The application of the said vegetable matters in the manner before described, to the stuffing of cushions and mattresses.

NOTES AND NOTICES.

Copper Balloon.—A balloon composed of copper is so far completed, that it is now exhibited to the public: this immense globe is formed of sheets of copper, united and soldered. The object proposed by this experiment is to resolve the problem of the practicability of the employment of metals in the construction of balloons.—*Paris paper.*

A New Propeller.—An invention has been made by an ingenious mechanic of Edinburgh, of a new mode of giving motion to vessels, doing away with paddle-wheels and boxes, as well as the Archimedian screw. It is a simple revolving cylinder, placed midships, which acts as a windlass, and makes a rope of the sea; in fact, the velocity acquired is in proportion to the quantity of water discharged by the agency of the cylinder, through a discharging nozzle at each side of the vessel, and what is curious, the discharging nozzles can be turned by a simple operation on deck, so as to stop the vessel, make her move backward or round as on a pivot, within her own length, without even the knowledge of the engineer, or the assistance of the rudder, as no stoppage of the engine is necessary for the purpose. The convenience is a smaller consumption of fuel, and the capability of the broadside carrying an entire armament.—*Scotsman.*

An Old Printing Office.—The printing office established by Christopher Plantin, about the year 1530, at Antwerp, then a great commercial emporium, has survived to our time in active operation, through the descendants of his daughter, the wife of John Moret, whose name the press has continued to bear. The Polyglot Bible of 1666-1678 is an enduring monument of Plantin's press, of which some of the productions attest the existence in 1555.

Fountain Extraordinary.—The great fountain now in progress at Chatsworth, is expected to play to a height of upwards of 200 feet. The fountain that plays the highest jet of any fountain in the world at present is in Germany, but the proposed fountain at Chatsworth is expected to surpass it in height about 20 feet.—*Derby Mercury.*

Hot Blast Case.—We understand that the proceedings in this long-litigated case have been finally settled by compromise—the Messrs. Baird, the last of the parties with whom an arrangement had to be made with the patentees, having agreed to pay 100,000*l.* for the use of the patent, and a farther sum of 6,000*l.* in name of expenses. We learn that, had the original demand of the patentees—viz. 1*s.* per ton—been acceded to, and no attempt been made to break the patent, the whole amount to be paid would not have exceeded 7,000*l.* The other parties interested in the case had, previously to the above arrangement, compromised for 5*s.* a ton.

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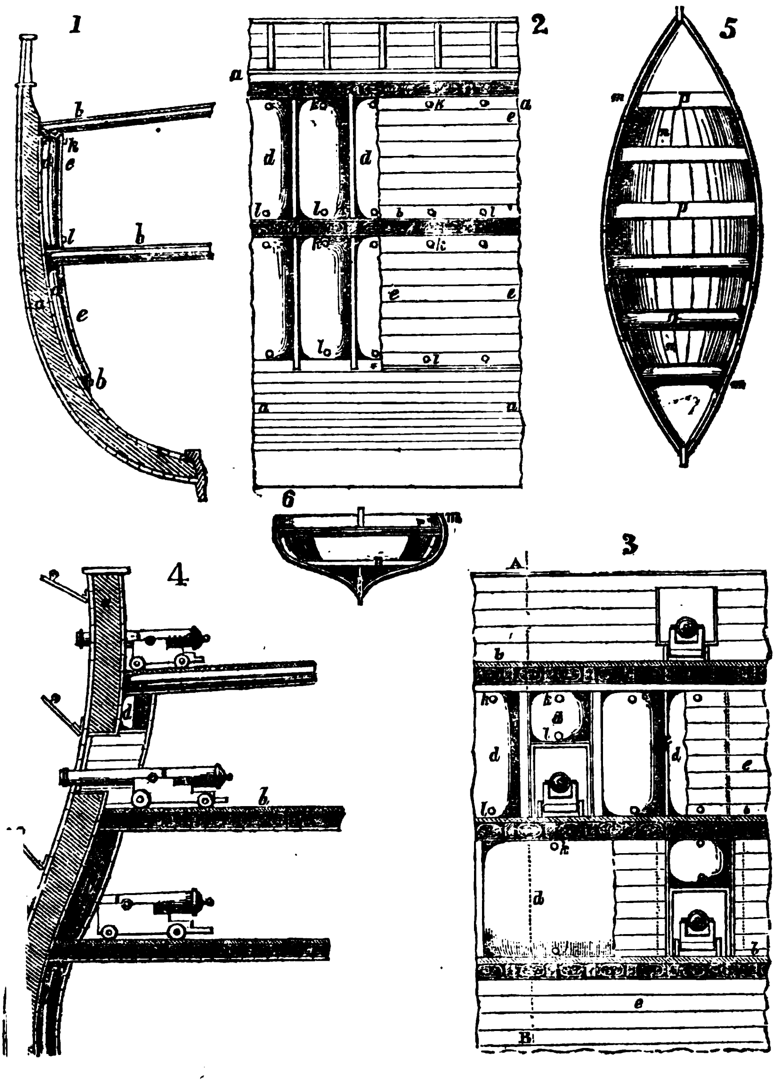
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1077.] SATURDAY, MARCH 30, 1844. [Price 3*d*.

Edited by J. C. Robertson, No. 166, Fleet-street.

MR. W. H. GIBSON'S METHOD OF PROTECTING SHIPS, AND ALL OTHER SORTS OF MARINE CRAFT, FROM SINKING OR FOUNDERING.



MR. W. H. GIBSON'S METHOD OF PROTECTING SHIPS, BOATS, AND ALL OTHER SORTS OF MARINE CRAFT, FROM SINKING OR FOUNDERING.

Fig. 7.

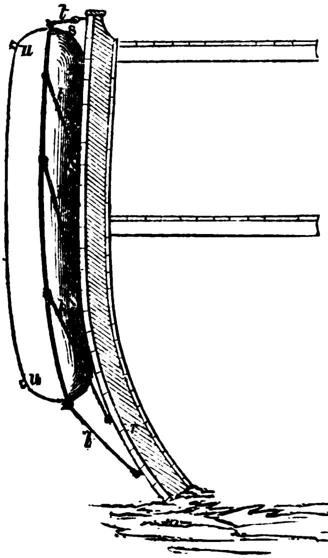
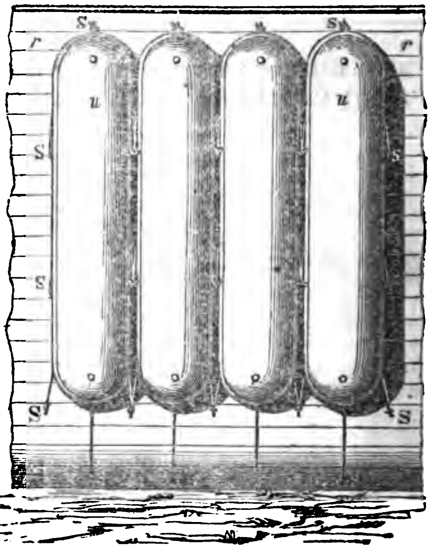


Fig. 8.



The object which the present patentee has proposed to himself to accomplish, is the very benevolent one of rendering the way for, "those who go down to the sea in ships" as safe nearly as travelling on the solid land. He proposes to construct every sort of vessel which floats on the water in such manner that it shall be absolutely insubmergeable. Every hull, great or small, is to be provided with hermetically closed air cells or chambers, of sufficient aggregate capacity to buoy it up under all possible circumstances, saving only that of a breaking up and parting of the timbers by main force. The well-informed reader will perceive at once, that in the general conception of this scheme there is nothing new; many plans to the same effect, and dependent on the same agency, having been at different times before proposed. The merit of Mr. Gibson's invention, can only therefore consist in the greater success with which he has mastered the practical details of the subject than others; and these we shall now leave the inventor himself to describe to our readers.

Fig. 1 exhibits a transverse section of the half part of the hull of a vessel, showing two distended bags suspended against the inside of the vessel, and protected by a lining of boards or planks. Fig. 2, an elevation of the inside of the vessel, representing two tiers of suspended bags partly covered with the lining.

Fig. 3 is an elevation of the inside of the same vessel, representing part of the lining and some of the bags suspended against the sides, with sections of other bags placed between the deck beams. *a*, the outer part of the hull; *b*, the decks; *c*, the deck beams; *d*, bags shown as distended with air; *e*, the lining; *f*, ribs between the bags, to which the boards of the lining are nailed; *g*, bags shown in section as placed between the beams of the decks, and supported by boards nailed up to and under the beams; *h*, a bag shown in section as suspended against the side of the vessel of war (see fig. 4); *k*, short pipes furnished with inlet valves secured into the upper parts of the bags, for allowing air to be forced into the bags and preventing its return by the same pipes; *l*, short pipes near the bottoms of the bags, furnished with outlet valves,

Fig. 9.

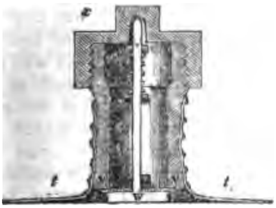


Fig. 10.

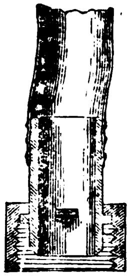
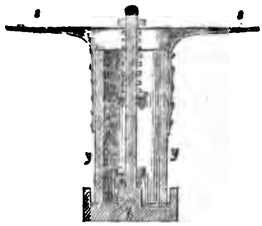


Fig. 11.



kept close by springs of such a force as shall be determined on as necessary to let out the surplus air, and thus to prevent the injurious tension of the bags.

Fig. 4 is a transverse section on the line A B of fig. 3, of a portion of a vessel of war, showing the manner of placing the bags against the sides and between the deck beams.

Fig. 5, plan of a life-boat, having inflated bags placed around the inner sides of the boat and under the thwarts, some of the thwarts having been removed to render the bags visible.

Fig. 6, transverse midship section of the same. *m*, the sides of the boat; *n*, the flooring of the boat; *p*, the thwarts; *q*, the bags.

Fig. 7 is a transverse section of part of a vessel supposed to be sunken in the ground, showing how by a similar application of inflated bags attached to the outside, the vessel may be raised.

Fig. 8. Outside elevation of the same, showing several bags and their attachments; these bags are made with a strong surrounding border, in which several strong loops or eyelet holes are formed, whereby the bags may be lashed to the hull: similar letters refer to similar parts in figures 7 and 8. *r*, the hull; *s*, eyes or rings screwed into the hull to form attachments for the bags; *t*, ropes tied to the bags and to the screw eyes; *u*, the bags furnished with inlet and with safety valves, and tied to the rings.

Fig. 9 is a section about half size, of an inlet pipe and valve attached to, and opening into the bag. This pipe is shown as covered with a cap to keep out dirt when not in use. *v*, the pipe; *w*, the valve; *x*, the cap; *t*, a part of the bag.

Fig. 10, part of a hose leading from an air-pump, with a coupling joint to be screwed on upon the inlet pipe when its cap is removed.

Fig. 11, the safety or outlet pipe and valve. *y*, the pipe; *z*, the valve; *s*, a part of the bag.

ON THE NUMERICAL SOLUTION OF EQUATIONS—PART IV., EXTENSION OF THE PROCESS.

Sir,—In concluding the present series of papers on Horner's method of solving nations, I wish to say a little on the ionale of the method, and to propose extension of it, which the remarks I ve to offer seem to suggest.

If any number, n, of binomial facs, of the form $x-a$, $x-b$, $x-c$, &c. multiplied together, the product is expression of the form

$$+ Ax^{n-1} + Bx^{n-2} + Cx^{n-3} + \dots + Px + Q,$$

which A = the sum of the quantities a, b, c, &c., with its sign changed; B = the sum of the products of every two of them; C = the sum of the products of every three, with its sign changed, and so on to the last term Q, which is the continued product of the whole n quantities a, b, c, &c., and the sign of which product will be changed or not, according as n is an odd or an even number. The absolute signs, and the magnitudes of the co-efficients A, B, C, &c., will evidently depend upon the relative signs and

the magnitudes of the quantities a, b, c, &c., and hence some of the powers of x in the foregoing expression may be altogether wanting. Still, zero being admitted as a possible value of any or all of the co-efficients, the expression will retain the above form, whatever may be the signs or values of a, b, c, &c.

It is the converse of this proposition with which we have to do., viz., that every expression of the form

$$x^n + Ax^{n-1} + Bx^{n-2} + Cx^{n-3} + \ldots + Px + Q$$

is the product of n binomial factors of the form $x-a$, $x-b$, $x-c$, &c. Now this converse is universally true, provided that we admit amongst the values of the quantities a, b, c, &c., not only rational and irrational numbers, but also imaginary quantities, that is, quantities involving even roots of negative numbers. The present is not the place to attempt a demonstration of this theorem, and I must therefore, in what follows, take the truth of it for granted. From the theorem just enounced it follows, that the general equation of the nth degree

$$x^n + Ax^{n-1} + Bx^{n-2} + Cx^{n-3} + \ldots + Px + Q = 0,$$

may be always written in the form

$$(x-a)\ (x-b)\ (x-c) \ldots (n \text{ factors}) \ldots = 0.$$

And in this form it evidently appears that the equation will be satisfied if any one of the factors, $(x-a)$, $(x-b)$, &c., be made $= 0$; that is, if x be made equal to any one of the quantities a, b, c, &c. Hence it follows that, the quantities a, b, c, &c., being n in number, every equation of the nth degree has n roots. These roots may not be all rational, or even real, and possibly none of them may be so. Still it is not the less true that in every equation of the nth degree there are n quantities admitting of algebraical representation, the substitution of any one of which for x will cause the left hand member of that equation to vanish.*

From this it appears that the simple equation has one root, the quadratic two roots, the cubic three, and so on.

Now in the equations solved in the previous papers, only one root was found in each case. When this was done we chose to consider the operation at an end. But since, as we have just seen, each of those equations possesses more than one root, let us enquire what it was that determined the finding of one of them in preference to the others. This will soon appear to have been the result of our having stumbled, in the first instance, upon the limits between which that root was contained. Hence, if we can find the limits of the other roots, for aught that appears, those roots will admit of being determined with the same facility as the roots already found.

For example, returning to the cubic equation solved on p. 151. The successive substitution of 100 and 200 for x in this equation having given results affected with unlike signs, we concluded that a root lay between those limits,* and, proceeding as directed, we found that this root was 123. Now had we substituted 300 for x, we should have found that the result differed in sign from that produced by the substitution of 200, and hence we should have inferred that a root lay between 200 and 300. Accordingly, applying Horner's process to the equation, and involving with 200, 10 and 6 as multipliers, the last co-efficient will be exhausted as before; and hence the root between the specified limits is 216. In like manner 1 and -100 will be found to be limits of the third root, and involving with -100 and $+3$, or -90 and -7, we should find this root to be -97.

But all the roots of an equation, when these are real and rational, may be found in a different manner, which is suggested by a slight consideration of the rationale of the general process.

The effect of the partial operations, called involutions, may be thus described: The completion of the first involution presents us, in the numbers then at the bottom of the several columns, including the first co-efficient, which remains unchanged throughout, with a set of co-efficients belonging to a new equation, the roots of which are respectively less

* It is the finding of these roots, in terms of the co-efficients A, B, C, &c., that constitutes the *general* solution of an equation. This must be carefully distinguished from the *numerical* solution. The latter problem, as regards equations of all orders, has been completely solved by Mr. Horner. The former has as yet received no solution as regards equations of a higher degree than the fourth.

* The inference we are entitled to draw in such a case is, that *one, or some other odd number* of roots, lies between the limits specified.

than those of the original equation, by the number used as the multiplier in that involution; and the completion of each subsequent involution presents us, in like manner, with another set of co-efficients which belong to an equation whose roots are respectively less than those of the original equation by *the sum* of the numbers used as multipliers in all the previous involutions.

Thus, recurring once more to the operation on page 151, we have, on the completion of the first involution, the equation,

$$x^3+58x^2-24715x+525596=0,$$

the roots of which are respectively less by 100 than the roots of the original equation. The completion of the second involution gives the equation,

$$x^3+118x^2-21195x+62496=0,$$

the roots of which are respectively less by $100+20$, or 120, than those of the original equation. And the completion of the third involution, (which was completed with a view to this extension) gives the equation,

$$x^3+127x^2-20460x=0,$$

the roots of which are respectively less by $100+20+3$, or 123, than the roots of the original equation.

But a root of this equation is manifestly 0. Hence, agreeably to what has just been shown, $0+123$, or 123, is a root of the original equation.

The other two roots of the last equation are evidently the roots of the quadratic, $x^2+127x-20460=0$, to which division by x depresses it. Accordingly, applying Horner's method to this quadratic, the last co-efficient is exhausted by involving with 90 and 3 as multipliers, and the resulting equation is $x^2+313x=0$, a root of which is evidently 0. Hence, $0+90+3$, or 93, is a root of the quadratic; and $93+123$, or 216, is a second root of the original cubic.

The remaining root of the quadratic $x^2+313x=0$, is evidently the root of the simple equation $x+313=0$; and this root being manifestly -313, we have $-313+93$, or -220, for the remaining root of the quadratic

$$x^2+127x-20460=0,$$

and $-220+123$, or -97, for the third root of the original cubic.

The whole operation may evidently be conducted continuously, in which form I give the portion of it succeeding that on page 151; premising that, as to avoid interruption to the continuity I do not change the signs of the terms which successively become the last term, those terms are exhausted by addition instead of subtraction.

			123	Root already found.
1	+ 127	− 20460	90	
	90	19530	3	
	217	− 930††	216	2nd Root.
	90	930	− 313	
	307††	0	− 97	3rd Root.
	3			
	310			
	3			
	313***			
	− 313			
	0			

To illustrate more fully this extension of the process, I give a concluding example. Required the roots of the equation.

$$x^4+2x^3-30561x^2+82664298x-5785049160=0.$$

The solution is as follows, in which, signs of none of the co-efficients ng changed, the operation in all the columns is addition throughout, regard being of course had to the relative signs of the numbers to be added,

	1	+2	—305061	+82664298	—5785049160
		100	10200	—29486100	5317819800
		102	—294861	53178198	— 467229360*
		100	20200	—27466100	419833560
		202	—274661	25712098*	— 47395800†
		100	30200	— 4720420	47395800
		302	—244461*	20991678	0
		100	8440	— 4543620	
		402*	—236021	16448058†	
		20	8840	— 649458	
		422	—227181	15798600	
		20	9240	— 645066	
		442	—217941†	15153534**	
		20	1455	—14489010	
764†† —		462	—216486	664524††	
7		20	1464	— 664524	
771		482†	—215022	0	
7		3	1473		
778		485	—213549**		
7		3	52560		
785***		488	—160989		
100		3	60660		
885		491	—100329††		
100		3	5397		
985†††		494**	— 94932		
1		90	5446		
986		584	— 89486***		
1		90	88500		
987****		674	— 986†††		
— 987		90	986		
0		— 764††	0		

100	
20	
3	
123	Root.
90	
7	
220	Root.
100	
1	
321	Root.
— 987	
— 666	Root.

As connected with this extension of the method I have only farther to remark, that the roots may be found in any order. Involution with the component parts of any one of them will exhaust the last column; and in each succeeding stage of the process involution with the component parts of the difference between the root last found and any one of those remaining to be found, will exhaust the column, which at that stage is the last. When all the columns have been exhausted in this way, except the first working column, and the involution completed, there will be found at the bottom of the column named a number which, divided by the first co-efficient with its sign changed, will give the difference between the root last found, and the only remaining root.

I am not aware that this extension of the method has been before proposed. Nevertheless, it seems to follow so obviously from attention to the rationale of

the involving process, that although I believe I am the first to publish it, I should be surprised to learn that I am the first to whom it has occurred.

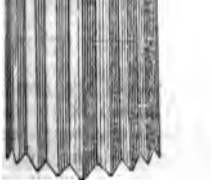
A word now as to the means of acquiring a practical acquaintance with this process, and I have done. I think it is probable, if I may judge from my own case, that a person to whom this method is presented for the first time, will find considerable difficulty in tracing the various steps of the process through the successive columns; and he will certainly be altogether unable to appreciate the beautiful simplicity of the principle which regulates the operation. This arises from the whole of the operation being in his view at once, in consequence of which he is continually liable to lose his place, and so to get into confusion. This difficulty will be completely removed, or rather it will be found not to exist, if the learner will try an example for himself. The numbers in course of being operated upon are then always at the bottom of the several columns, so that mistake is hardly possible; and in this way the extreme simplicity of the operation will become apparent.

With best thanks, Mr. Editor, for the space you have so kindly afforded me, I remain, very respectfully yours,

G.

Hermes-street, Pentonville,
March 21, 1844.

DANCER'S CRIMPED OR CORRUGATED BATTERY PLATES.



Sir,—In my *Contributions towards a History of Electro-Metallurgy,* I have alluded to the corrugated or crimped galvanic battery plates introduced by Mr. J. B. Dancer, in 1838-9. The annexed figure is designed to represent the copper-plate so prepared by being passed through grooved rollers, or pressed between proper cast iron dies; it is intended to obtain the greatest surface within the smallest compass, and may serve to lessen the bulk of batteries requiring 100 or more jars, being very economical of space.

I am, Sir, your obedient servant,

H. Dircks.

77, King William-street, City,
March 25, 1844.

ON THE CONSTRUCTION OF FIREPLACES.

Sir,—The acknowledged difference of effect between a stove and an open fire, in warming the air of a room from a given quantity of fuel, is almost wholly due to the loss or waste of heat by the chimney of the latter. It may perhaps be admitted that the combustion of the fuel is also more perfect in a stove than in an open grate, and consequently less loss of combustible material, in the form of smoke, is incurred. But the difference in this last respect is too small to account for the disparity of the results. We may say then that nearly the same amount of heat is given off in both cases, yet the resulting effects are quite disproportionate. This can only be owing then to a great portion of the heat of an open fire passing off by the chimney, and which, as to any beneficial effect in aiding the temperature of a house, is absolutely lost or wasted according to the present method of constructing chimneys. From the materials, of which they are constructed being bad conductors of heat, little of the heat of the ascending current is abstracted or absorbed, and from their mass or thickness, what little is absorbed never penetrates through, so as to affect the temperature of any part of a house; but when the fires are put out at night, the heat which has been absorbed during the day is given out again to the cold air in the chimney, and dissipated in the atmosphere. The object of a preceding communication which I made to you was to propose recovering and turning to useful account part of the heat thus wasted, by adopting, in lieu of a common chimney, an iron flue, placed in a recess communicating with the rooms of a house, which, being a good conducting

material, and thin, and presenting a large surface in connexion with the air of one or more apartments, would have much of the effect of a stove, combined with the cheerfulness and free ventilation of an open fire.

But though there is a great loss and waste of heat from an open fire, attributable to the present mode of constructing chimneys; the evil is very unnecessarily aggravated by the way in which fireplaces are usually made and fitted up. Take the generality of fireplaces in ordinary houses, (I speak not of those fitted up with register, or other expensive grates,) and they will be found to be nearly a rectangular recess, gradually contracting above to the dimensions of the chimney; and in this a grate is fixed. Now it is obvious that every particle of air which once enters the jambs or opening of such a fireplace, as surely goes up the chimney, as every particle of water falling within the edge of a funnel would pass down its neck. But it is to be considered that the whole interior of a fireplace becomes more or less heated from the fire, and that successive particles of air are constantly impinging on every part of the surface, abstracting a certain portion of heat from it, and then passing up the chimney. No portion of the air thus warmed ever returns into the room to communicate any of its acquired temperature, though far more is momentarily entering the fireplace than is at all necessary for the combustion of the fuel. What is required, then, is to prevent the loss of so much warmed air,—to render the interior of a fireplace serviceable in warming air, not to pass up the chimney, but to return into the room; and to confine the current passing up the chimney as much as possible to the limits of the fire itself. For this purpose it is necessary, not only to contract the opening for the passage of the smoke into the chimney, but also to give the interior of the fireplace such a form as will cause the circulation of a current of warmed air from it into the room, distinct from the current of smoke, &c., passing into the chimney. This may be done in the way represented in the annexed engravings; fig. 1 being a front view of the fireplace, and fig. 2 a side elevation and section on the line *a b*. It will be seen that the only difference from an ordinary fireplace consists in two cheeks or cast iron plates C C, projecting from the back of the fireplace, above and on a line with the sides of the grate; above they project as far as the front of the grate, thence receding and joining the side plates of the grate, which need not be more than 6 inches, the rest of the grate being of open bars. The top of the fireplace is all closed or built up, except an opening for the smoke between C C, and is so formed as to facilitate the air, which impinges on all parts exterior to the two cheeks, returning into the room after being warmed by contact with the heated surfaces. This effect is also assisted by

Fig. 1.

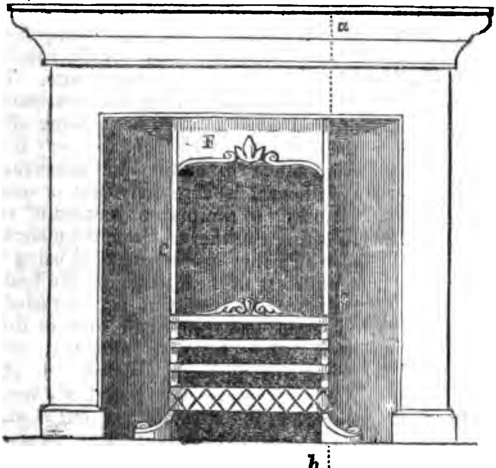
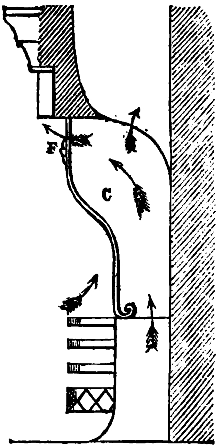


Fig. 2.



a front plate F, connecting C C above, and depending from the top of the fireplace not more than 4 or 6 inches; by which means the air escaping at the top of the fireplace, is prevented from being drawn into the current passing up the chimney. The opening for the smoke may be advantageously contracted to 8 inches square, which is sufficient for the free passage of the smoke of any ordinary fire. If there were no other reason for it, contracting the throat of a chimney, every other part of it remaining as before, is a good preventive of its smoking; which I conceive is to be explained by supposing, that contracting the opening through which the smoke passes into the chimney, so concentrates the upward current at that particular point, as to baffle or counteract any downward tendency which may have been given to the smoke in the chimney by winds, &c.; hence, the motion of the down current is there extinguished, and reversed in an opposite direction, and the general habitude of the smoke to rise is enabled to prevail over the opposing force.

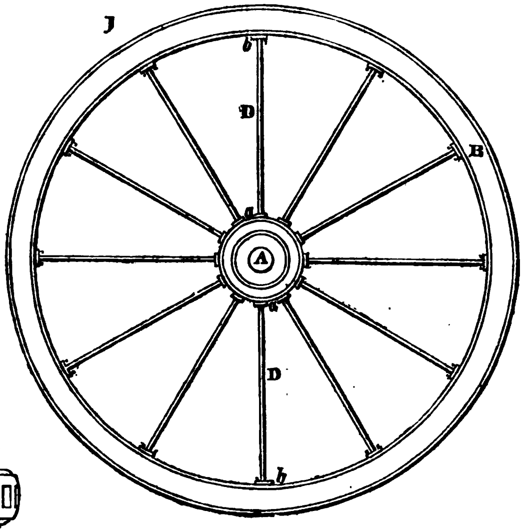
I am, Sir, yours, &c.,

N. N. L.

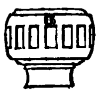
March, 1844.

IMPROVED CARRIAGE WHEEL. THOMAS LEFTWICH, OF CUMBERLAND MARKET, LONDON, PROPRIETOR.

[Registered under the Act for the Protection of Articles of Utility.]



2.



3

Figure 1 is an elevation of this wheel; figure 2 is a side view of the nave, and figure 3 an inside view of part of the felloe.

A is the nave; B, the felloe, and C the tire; D D are the spokes, which are formed of bars of iron, with cross flaps *a* and *b*, one at each end at right angles to the spokes, whereby they are made fast to the nave and felloe, the flaps being perforated with holes, one on each side, through which screw bolts are passed.

Instead of each spoke having such a cross link at both ends, it may have it at the outer or felloe end only, and the inner end may have a thread turned upon it so as to take into a screwed recess in the nave.

THE ROYAL STEAM MARINE SERVICE.

A Court Martial was held on Monday last, on board of the flag ship *St. Vincent*, at Portsmouth, rear admiral Hyde Parker, C.B., president, to try Mr. James Hand, second engineer of H. M. steamer *Prometheus*, Lieut. Pasco commander, on the following charge:—"For that the said Mr. James Hand, second class engineer of Her Majesty's steam vessel *Prometheus*, did on the 27th day of February, 1844, while the engineer on watch, grossly neglect his duty, by having allowed the water in one of the boilers on board the said vessel to get considerably below its proper level, and for not having taken the proper steps to arrest the mischief thereby incurred, whereby the vessel was prevented from proceeding on her voyage after reaching Madeira, and which has occasioned great inconvenience to Her Majesty's service, and rendered a considerable outlay necessary."

Four witnesses were examined for the prosecution—namely, the commander of the vessel, Lieut. Pasco; the first engineer, Mr. Fraser; Mr. Joseph Wallace, second master; and Mr. Thomas Lloyd, chief engineer of Woolwich Dockyard. It appeared that on the night of the 27th of February, or rather on the morning of the 28th, Lieutenant Pasco, being in his berth, was awoke by the stopping of the vessel, then off Madeira. On rising to inquire the cause, he discovered a strong and offensive smell issuing from the engine-room, which he found proceeded from the ignition of some felt, placed, as is usual, between the two boilers. On prosecuting his inquiries further, he found that the port boiler was at the time so hot as to be nearly at red heat, (hence the smell from the felt,) consequent upon its not being sufficiently supplied with water by Mr. Hand, the engineer on duty, who alleged as an excuse for his culpable neglect, that on making the discovery he was frightened, and did not know how to act. Lieutenant Pasco, finding the vessel so disabled, and it being impossible to get the damage repaired at Madeira, made sail for the first British naval port, and communicated his disaster to Sir David Milne, Commander-in-Chief at Devonport, from whence he sailed to Portsmouth.

Mr. Lloyd, chief-engineer at Woolwich Dockyard, proved the damage done to the boilers to be the result of carelessness and neglect, and, although the boilers were tubular ones, they do not require any more skill in management than common ones, and gave it as his opinion that the damage done could not be repaired in less time than one month, and would cost from 300*l*. to 400*l*.

The prisoner produced two witnesses in defence, one an apprentice on board. Their evidence, however, was unimportant. Lieutenant Pasco, and also Mr. Lloyd, gave the prisoner a good character for sobriety and general attention to his duties, and also for his qualifications as a thorough engineer.

The court was cleared for the consideration of the verdict, and, on re-opening,

The JUDGE-ADVOCATE delivered as the result of the deliberations of the Court, that the prisoner be dismissed Her Majesty's service.

AMERICAN RAW SILK.

Mr. Ellsworth, the American Commissioner of Patents, affirms that the American raw silk is in quality superior to the foreign article. He states that a person, for many years engaged in the weaving of silk in different establishments in London, having had (as he says) for fifteen years from 250 to 300 lbs. of silk, of every grade and name, passing through his hands weekly, expresses the following opinion as to the silk, &c., of the United States:—

"I am qualified to affirm, from various experiments I have tried, that the silk is superior to any I have seen from Italy, China, France, Piedmont, or Valencia, where the worms are fed upon multicaulis or Italian. Its brilliancy, strength, and scent are superior. I am aware that an exposure to the saline air, in the passage across the ocean, may be the cause of the loss of fragrance to imported silk; but the brilliancy is peculiar to American silk, if reeled in a proper manner, with cleanliness.

"I am confident that the mammoth sulphur worm is the pure Fossam brown. To try this, I had about 3 lbs. of silk reeled, and enclosed it in an air-tight box for three weeks. When I took it out, it had the fragrance of the Fossam brown stronger than any that I ever smelt in England, which convinced me that the mammoth sulphur is the identical silk which is always from 5*s*. to 8*s*. per lb. higher than ordinary silk. The mammoth white and the pea-nut white is a Novi, and superior to any I have seen in England. The yellow or orange I cannot, satisfactorily to my own mind, yet define, but am trying experiments in order to ascertain. I am strongly persuaded it is a Bergam. Should this be the case, it will prove a great acquisition to manufacturers of silk velvet. Some have supposed the pea-nut white is the Piedmont, but they are mistaken. The Piedmont cocoon is lily white, very diminutive, with a sharp point."

THE LATE BOILER EXPLOSION AT BRADFORD.

Sir,—Your Bradford correspondent asks in your Number for last week, for any suggestion which may throw light on the cause of the lamentable explosion of a boiler in that town. I am by no means certain that the following considerations will perfectly account for it; but I offer them in the hope that the rationale they suggest will be kept in mind, when, on the occurrence of any such catastrophe in future, the state of things preceding the explosion is inquired into.

It is well known that, from particle to particle of its own substance, water is a slow *conductor* of heat, although when its particles are in motion, they convey it with considerable rapidity. It is, perhaps, not so generally known that, if slowly heated, and kept perfectly still, water may be heated much above the boiling point without ebullition, or indeed forming steam, except, perhaps, in small quantities. When water so heated is shaken suddenly, though but slightly, a large volume of steam is instantly produced. The sudden drawing off of a quantity of steam from a boiler by setting the engine a-going, or opening a safety valve, always produces violent ebullition, although the water had previously been perfectly still.

With these facts before us, let us suppose that a boiler and its water have been very slowly heated, and in consequence of the defective conducting power and stillness of the water, its different strata are combined with different quantities of heat; but, on the whole, heat enough is present to convert a large quantity of water instantaneously into steam. Now let us suppose the engine to be started, or the safety valve opened: the water is agitated, the different strata are mixed, an immense quantity of steam is generated, and the boiler fails. And not only so, but it is not improbable this steam is formed from the lower strata of water, and blows up, against the roof of the boiler, that water which lies above it. The stroke may either rend the boiler, or lift it whole from its seat, as sometimes happens.

In the Bradford case, the particulars are given with such minuteness as to enable to judge whether the explosion may be s accounted for; but I observe it is said the engine tenter, "I went to the mill at f-past five on Saturday morning. I ked into the fire-holes under the boiler, *saw the fire had been stirred up by the tchman, and was very low. I spread it r the grate, and threw on a few coals, shut the doors,"* &c.,—a statement ich leaves room for supposing that the er had been subjected to the slow heating necessary to produce the explosion on the principles now suggested.

J. C.

Lisson Grove, March, 1844.

PIRACY OF DESIGNS.

Guildhall, Wednesday, March 27.

(Before Alderman Gibbs and Alderman Hughes.)

Hughes v. *Bennett.*

An information was laid under the Designs Registration Act, (5th and 6th Vic. cap. 100,) by Hesketh Hughes against Joseph Bennett, for selling a certain quantity of lace rouche, ornamented with the dahlia leaf, which ornament had previously been registered by the complainant.

It appeared that the Registration was effected on the 8th of February last, after eleven o'clock in the morning; but that the complainant had sold at eight o'clock in the morning of that day, a box containing 12 yards of rouche ornamented with the design in question; which was held to be a publication, and the magistrates dismissed the information.

The defendant's solicitor applied for costs, but the magistrates did not think it a case in which the costs should be awarded.

ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

Henry Page, of Cambridge, Painter, *for certain improvements in the mode of painting, graining, or decorating with oil, and other colours.* Patent dated, June 10; Specification enrolled, December 10, 1843.

The invention consists in a peculiar process by which "graining" is rendered more simple, less expensive, and more decorative.

The surface to be decorated, is first covered with a coating of oil-paint in the ordinary manner; when dry, this oil-paint is covered over with distemper colour, softening it off with a brush in the ordinary way; and while this is quite wet it is variegated according to taste, with brushes, sponges, or other suitable materials or instruments, the same instruments or materials being previously dipped in any spirit, that will not injure the oil-paint ground, or prevent the varnish (afterwards applied) from drying.

George Bennetts, of Gunnis Lake, in the County of Cornwall, Civil Engineer, *for improvements in steam-engines and boilers, and in generating steam.* Patent dated August 15, 1843; Specification enrolled February 15, 1844.

The invention consists in the construction and arrangement of certain apparatus in connexion with the engine and its boiler, for the purpose of rendering the steam which has been employed in working the engine, and is on its passage into the condenser or into the atmosphere, available for heating the water from which the steam is to be generated; and it further consists in generating steam by injecting water, in small jets, into generators clear of water, and maintained at such a temperature as to convert the water into steam on its coming in contact with the surface of the generator.

The first part of the invention consists of a vessel formed of three cylindrical pieces, bolted together so as to make steam-tight joints. At each of the places where these pieces are joined, there is an internal projection, which reduces the area of the vessel at that place so as to allow only sufficient space for the water, at each stroke of the pump, to pass in a thin sheet between the outside of the eduction pipe and these projections. The eduction pipe passes through this vessel, and at the end of the vessel where the pipe protrudes, a steam-tight joint is formed. This vessel is to be capable of containing as much water as is required to supply the engine with steam for eight or ten minutes. A double action forcing pump is connected at its eduction passage by means of a pipe with the aforesaid vessel, and at its induction passage by means of a pipe with a discharge cistern. There is also a pipe leading from the aforesaid vessel to the generators or boilers. A valve is placed in pumping engines, which should be kept open while the engine is in motion so as to offer no resistance to the steam in passing from the cylinder. When the engine is at rest this valve should be shut and the steam allowed to pass into the eduction-pipe, where it gives out its heat, to the water in the aforesaid vessel.

The mode of action of this part of the invention is as follows:—If the aforesaid vessel is filled with water, and the pump set in motion, the water which it forces into the said vessel will circulate through it for eight or ten minutes until it is forced into the generators or boilers, and during the time it has remained in the said vessel, will have taken up as much heat as the steam is capable of communicating, and the water entering at the part of the vessel next the condenser where the eduction-pipe is coldest, and being forced out where the same eduction-pipe is hottest, it is forced at each stroke of the pump into a hotter portion than that which it occupied before, whilst the area of the vessel, being contracted so as to allow only sufficient room for the water forced in by the pump to pass freely, prevents the water that has already passed these places from returning. The patentee states that he does not claim the use of steam after it has performed its work in the cylinder generally, for the purpose of heating the water, but only when applied according to the modes described.

The second part of the invention consists in a mode of generating steam, by injecting water upon the surface of metals raised to such a temperature as to convert such water immediately into steam. There is a flue leading from the fireplace to the back end of the generators, the width of which flue is equal to the sum of the diameters of the said generators. On arriving at the end of these generators opposite the furnace door, the flue turns upwards, and joins a flue at the ends of the generators, which divides and enters flues which proceed to the chimney. The generators (which are made of any metal of sufficient strength to bear the pressure of the steam, and remain uninjured by the action of the fire) are so connected at their ends, by means of pipes and branches, as to form one continuous vessel. A pipe leads from the water-heating vessel, through which the water passes into the generators, through branches and pipes placed in the interior of the generators. These pipes project as far into the generators as the end of the fireplace, and are perforated throughout their length with small holes. They are also furnished with a flanch of the same size as the external diameter of the generators, to the ends of which they should be fastened by means of an internal flanch.

The manner of using this part of the invention is as follows:—To start the engine a sufficient quantity of water is placed in the generators; and if it be not wholly used in such starting, no more water is to be injected until it is exhausted. When the water is exhausted, the force-pump is to inject, at each stroke of the engine, a sufficient quantity of water to supply the engine with a stroke of steam. The water being divided by the aforesaid perforated pipe into a number of minute jets, and coming in contact with the heated surfaces of the generators, is converted into steam, which steam proceeds to the engine, or escapes into the atmosphere. The steam being made to pass through the generators, has its elasticity increased considerably, whilst the water is converted into steam (when thrown on the aforesaid heated surface in such minute jets) with less fuel than is used when a body of water is suffered to lodge in them. The fire may be regulated by any of the well-known means, and care must be taken not to overheat the generators, which ought never to be brought to a temperature approaching to a red heat. A double-action pump is preferred for injecting

the water, as the supply is much more regular than it would be with a single-action one. To regulate the quantity of water to the demand of the engine, the chamber of the pump should be connected above and below the piston by a pipe large enough to allow the water which the pump is capable of raising to pass freely through it.

The patentee states that he does not claim the use of any of the several parts of steam-engines and boilers hereinbefore described, except when the same are employed in and for the construction and arrangement of the apparatus for the heating of the water by the eduction of steam, and in and for the generation of steam, as above described.

Mark Freeman, of Sutton, Gentleman, *for improvements in card cases.* Patent dated, August 22, 1843; Specification enrolled, February 22, 1844.

The improvements proposed by the patentee refer to a method whereby one card may easily be taken from the case, without pulling out the whole contents. This is obtained by means of a thin spring, or plate of metal, somewhat narrower than the cards, placed in the case towards one side; at the lower end it is turned up at right angles, the depth of the part so turned up being just so great, as that it lays hold of one card, and no more. Upon its being withdrawn, it brings the card along with it. There is a recess formed in the bottom of the case of sufficient width to allow the spring to go down, the cards resting on the bottom, on each side of the recess, thus ensuring the bent part on the end of the spring or plate, when pressed down, falling below the ends of the cards. To prevent more cards rising at once than that which is immediately brought up by the catch, there is placed another spring on one of the narrow sides of the case, so as to press on the edges of the cards; the spring being covered with a piece of rough cloth, sufficient friction is produced to retain all the cards except that being withdrawn.

The thin plate or spring which pulls up the card may either be attached to the lid, and so draw up the card with the same action whereby it is opened, or merely left to be se-arately withdrawn.

Villiam Fletcher, of Moreton H use, Buckingham, Clerk, *for certain i rovements for the purpose of securing c ks, or substitutes for corks, in the mouths o bottles, or vessels of the nature of bottles, w ther made of pottery, or of pottery of t kind called stone ware, or of glass.* P ent dated, August 24, 1843; Specificati n enrolled, February 24, 1844.

This invention relates to a method of so f ning bottles, or vessels of the nature of bottles, that wires may be introduced through the same, and through the corks inserted therein, in such manner that the corks may be securely held by such wires. The bottles are formed in the ordinary manner, except at the neck, through which a hole is made, immediately below the rim thereof; and when it is desired to secure a cork in a bottle, the cork is introduced into the mouth of such bottle, and driven down as far as is thought desirable, and a pin, or piece of wire, is then inserted in the hole, and passed through the cork.

NEW WORKS ON THE ARTS AND SCIENCES PUBLISHED IN MARCH, 1844.

The (Cambridge) Senate-house Problems for 1844. With Solutions, by Matthew O'Brien, M.A., Caius College, and Robert Leslie Ellis, M.A., Trinity College, Moderators. 4s. 6d.

Thorough Draining in Principle and Practice: its advantages and simplicity as applied to a Dead Level: addressed to the Owners and Occupiers of the Soil in the parts of Holland, in the County of Lincoln, and the great Level of the Fens. By John Clark. 12mo, (Long Sutton,) 1s. 6d.

Mathematical Tables, consisting of the Logarithms of Numbers, Logarithms of Sines, Tangents, and Secants, Natural Sines, and various other Tables useful in Business, and in Practical Geometry; together with Tables of Interest, Probabilities of Life, and Annuities. Carefully revised and corrected by John Christison, Mathematician. 4s.6d.

Smeaton and Lighthouses; a popular biography, with an Historical Introduction and Sequel. 2s.

On the Connexion of Geology with Terrestrial Magnetism, showing the General Polarity of Matter, the Meridional Structure of the Crystalline Rocks, their Transitions, Movements, and Dislocations; including the Sedimentary Rocks, the Laws regulating the Distribution of Metalliferous Deposits, and other Magnetic Phenomena. By Evan Hopkins, C. E., F. G. S. 8vo. pp. 138, 24 engravings, 10s. 6d.

Geological Observations on the Volcanic Islands, visited during the voyage of H.M.S. Beagle; together with some brief notices on the Geology of Australia and the Cape of Good Hope: being the Second Part of the Geology of the Voyage of the Beagle, under the command of Captain Fitzroy, R.N., during the years 1832 to 1836. By Charles Darwin, M.A., F.R.S. Published with the approval of the Lords Commissioners of Her Majesty's Treasury. 8vo, pp. 186, woodcuts, 10s. 6d.

Elements of Natural History, for the Use of Schools and Young Persons; comprising the Principles of Classification, interspersed with amusing and instructive original Accounts of the most remarkable Animals. By Mrs. Lee (formerly Mrs. T. E. Bowditch) Author of "Taxidermy," "Memoirs of Cuvier," &c. 12mo. Woodcuts. 7s. 6d.

Specimens of Decoration, selected from Raphael's Designs in the Vatican Palace, by Messrs. J. W. and W. A. Papworth. Royal 4to, 14 plates, 10s.

Researches on Light: an Examination of all the known Phenomena connected with the Chemical Influence of the Solar rays; embracing all the published Photographic Processes, and many new Discoveries in the Art, &c. By Robert Hunt, Secretary of the Royal Cornwall Polytechnic Society. 8vo.

An Elementary Treatise on Mechanics. By Andrew Searle Hart, LL.D. Fellow of Trinity College, Dublin, 8vo, (Dublin,) pp. 130, bds. 6s.6d

Periodicals.

The London, Edinburgh, and Dublin Philosophical Magazine. No. 155. 2s. 6d.

The Edinburgh New Philosophical Journal. No. 73. 7s. 6d.

The Civil Engineer and Architect's Journal. No. 79. 1s. 6d.

The London Journal (Newton's). No. 147. 2s. 6d.

The Repertory of Patent Inventions. Enlarged Series. No. 17. 3s.

The Glasgow Practical Mechanics' and Engineers' Magazine. Part 30. 8d.

The Artizan. No. XIV. 1s.

The Apprentice. No. 4, 5 and 6 (published weekly).

The Builder. Part XII. 8d.

Annals of Chemistry and Practical Chemistry. No. 28.

The Nautical Magazine. No. 14. Enlarged Series. 1s.

Pharmaceutical Journal and Transactions (Bell). 1s.

The London Polytechnic Magazine. Edited by Thomas Stone, M.D. No. 3.

Annals and Magazine of Natural History, including Zoology, Botany, and Geology. By Sir William Jardine, Bart., P. J. Selby, Esq., Dr. Johnson, &c. No. 133. 2s. 6d.

Chemical Gazette, or Journal of Practical Chemistry in all its Applications to Pharmacy, Arts, and Manufactures. By William Francis. 2s.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65. FROM 22ND FEBRUARY, TO MARCH 27TH, 1844.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
Feb. 22	128	George Forrester and Co.	Vauxhall Foundry, Liverpool...	A design for a wrought-iron wheel.
26	129	James Milne and Son......	Edinburgh...........................	An improvement on gas meters, preventing the possibility of their being overcharged with water, and thereby rendering it impossible that such meter can ever act to the disadvantage of the consumer.
27	130	Joseph Carter...............	Gentleman's Walk, Norwich ...	Design for a glove
28	131	Robert Cordon and S. Smith.....................	Nottingham	Design for a domestic gas generator.
29	132	Samuel N. Rodier	Exeter	Rodier's water repelling ventilator.
,,	133	Welch and Margetson	134, Cheapside, London	Improved collar.
March 1	134	Joseph Beaumont	Commercial Road, East	Sugar vacuum pan feed regulator
,,	135	M. Mayhew	Union-street, Southwark	Mayhew's design for an improved ventilating hat.
,,	136	John M. Duncombe	Buckingham	An improved button.
2	137	John Frearson..............	Birmingham	The radial button.
5	138	Waddington, Horton and Co............................	London-wall, London	Improved parasol.
7	139	Charles Bond................	62, Cannon-street, City	Improved winch handle for fishing reel.
8	140	Charles Fox Smith......	281, Strand, London, and Hatcham, Surrey	The Victoria lamp for burning camphine, alcohol, and other combustible fluids.
9	141	W. H. Childs..................	22, Providence-row, Finsbury-square	Child's improved brush.
,,	142	Joseph and Thomas Todd	3, Melbourn-place, Edinburgh	Metallic eyelet fastener.
,,	143	George Grainger	Worcester	Design for a drawing-room flower-pot in porcelain or earthenware.
12	144	Aaron Atherton and Co...	Wolverhampton	Iron for Ironing.
15	145	Thomas Leftwich..........	Cumberland Market, London...	Improved carriage wheel.
16	146	Topham and Fawcett......	Derby	Glove.
17	147	Edward Gimson............	Garratt-lane, Wandsworth	Gimson's improved washing or cleansing apparatus.
18	148	William Hancock, jun.....	Amwell-street, Middlesex	The triunite military and domestic shoe brush.
19	149	H. A. Holden.	96, Suffolk-street, Birmingham	Design for a lamp for the roofs of railway and other carriages.
20	150	Holden, Lowe, and Lowe.	Birmingham	Design for an improved carriage step.
,,	151	Cope and Collinson........	40, Fleet-street, Birmingham...	Improved screw for music stools.
22	152	John Warner and Sons ...	8, Crescent, Jewin-street, City	A design for combining two cocks with one handle to supply boilers and rangers with water, and to draw off water therefrom.
23	153	M. Merryweather	63, Long-acre, London...........	Cabinet fire engine.
27	154	John Hoskin and Co.......	Redruth, Cornwall	Smoke consumer.
,,	155	R. Wilkins	24, Long-acre, London...........	Improved catoptric lamp burner, for the combustion of rectified spirits and vegetable naphtha.

LIST OF ENGLISH PATENTS GRANTED BETWEEN 26TH OF FEBRUARY AND THE 28TH OF MARCH, 1844.

Isabella Larbalastier, of Noble-street, Falcon-square, furrier, for improvements in making certain skins resemble the sable fur. Sealed, February 26; six months.

Richard Kitson, of Cleckheaton, card manufacturer, and John Garthwaite, of Leeds, flax spinner, for improvements in wire cards for carding cotton, wool, silk, flax, and other fibrous substances, and for producing tow and yarns from line and tow-yarn waste, which comes from the spinning frames, commonly called hard waste. February 27; six months.

Charles Newington, of Ticehurst, Sussex, esq., for certain improvements in apparatus for ascertaining and indicating the time at which a person is present at a particular place. February 27; six months.

Thomas Harbottle, of Manchester, gentleman, for a machine designed for manufacturing boot soles and taps, and also for riveting leather hose and traces, and for other purposes, to which the same may be usefully applied. February 27; six months.

William Clegg Gover, of Chester-square, Middlesex, gent., for a method of casting off the sash lines and weights from the window sashes, and of taking out the window sashes from their frames without removing the beads. March 1; two months.

Joseph Crawhall, of Newcastle-upon-Tyne, rope manufacturer, for improvements in machinery for manufacturing ropes and cordage. March 2; six months.

John Stevelly, of Belfast, professor of natural philosophy, for improvements in steam engines. March 2; six months.

Henry Dunnington, of Nottingham, manufacturer, for improvements in the manufacture of fabrics produced in warp and lace machinery. March 4; six months.

Peter Ward, of West Bromwich, Stafford, practical chemist, for an improvement in combining matters for washing and cleansing. March 4; six months.

Samuel Atkinson, of Manchester-street, Gray's-inn-road, Middlesex, turner, for improvements in the construction of wheels for carriages. March 4; six months.

Bernard Peard Walker, of North-street, Wolverhampton, clerk, for improvements in machinery for making nails. March 6; six months.

Thomas Foster, of Streatham, Surrey, manufacturer, for improvements in preparing composition of India rubber, and other matters for forming articles therefrom, and for the coating of surfaces of leather, and woven, and other fabrics. March 6; six months.

William Henry Barlow, of Leicester, civil engineer, for improvements in the construction of keys, wedges or fastenings, for engineering purposes. March 6; six months.

William Fairbairn, of Manchester, engineer, for certain improvements in machinery used for propelling vessels by steam. March 7; six months.

Charles Townend, of Manchester, fustian manufacturer, for an improved process, or manufacture, w ereby cotton fabrics are aided and made repellant t vater and mildew, and any unpleasant smell is p vented in such fabrics. March 7; two months.

lexander Angus Croll, of Brick-lane, Middle-s , superintendent of the gas works, and William hards of the same place, mechanical inspector, f improvements in the manufacture of gas for the p pose of illumination, and in apparatus used w en transmitting and measuring gas. March 7; s months.

Vilton George Turner, of Gateshead, Durham, d tor in philosophy, for the manufacturing of salts o mmonia and compounds of cyanogen, from a s tance never before applied to that purpose, M ch 11; six months.

Charles Harrison, manager of the Coed Talon and Leeswood Iron Works, Flintshire, for certain improvements in the manufacture of cast iron pipes and other iron castings. March 14; six months.

Charles Roberts, of High Holborn, Middlesex, boot maker, for improvements in the manufacture of boot and shoe trees, lasts, and stretchers. March 14; six months.

William Godfrey Kneller, of Wimbledon, Surrey, chemist, for improvements in the preparation of zink, and in combinations of zink with other metallic bodies. March 14; six months.

Henry Pershouse Parkes, of Dudley, Worcester, manufacturer of chain cables, for improvements in the manufacture of flat pit chains. March 14; six months.

Samuel Cunliff Lister, and James Ambler, of Bradford, York, manufacturers for improvements in machinery for applying fringes to shawls and other articles. March 14; six months.

Frederick Stephenson, of High-street, Birmingham, comb manufacturer, for improvements in bookbinding, and apparatus for cutting books or other folded paper, part of which improvements is applicable to pen holders. March 14; six months.

John Browne, of New Bond-street, Middlesex, esquire, for improvements in urinary utensils. March 14; six months.

William Bown, of Leicester, glove and mit manufacturer, for improvements in weaving elastic fabrics. March 14; six months.

John Tatham, of Rochdale, machine maker, and David Cheetham, of the same place, cotton spinner, for certain improvements in machinery or apparatus to be employed in the preparation and spinning of cotton wool and other fibrous substances. March 14; six months.

Moses Poole, of Lincoln's-inn, Middlesex, gentleman, for improvements in steam-engines, steam-boilers, and furnaces or fireplaces. (Being a communication.) March 14; six months.

Emanuel Wharton, of Birmingham, engineer, for certain improvements in steam-engines, which are in whole or in part applicable to other motive engines, and to machines for raising or impelling fluids. March 14; six months.

Thomas Seymour, of Riding House-lane, Great Portland-street, Middlesex, gunmaker, and John Seymour, of Wellington-street, Gray's-inn-lane, lock filer, for an improved safety-bolt and tumbler, for the locks of certain kinds of fire-arms. March 14; six months.

William Henry Burke, of Tottenham, Middlesex, manufacturer, for certain improved machinery for cutting Indian rubber and other elastic substances into balls and other solid figures. March 19; six months.

William Saunders, of Bush-lane, London, chemist, for an improved apparatus for modifying temperature in the condensation of vapours, and in the cooling or heating of liquids and fluids. March 19; six months.

Hugh Inglis, of Kilmarnock, Scotland, mechanic, for improvements upon locomotive steam-engines, whereby a saving of fuel will be effected, which improvements are applicable to steam vessels and other purposes, and to the increasing the adhesion of the wheels of railway engines, carriages, and tenders upon the lines of rail, when the same are in a moist state. March 19; six months.

William Bates, of Leicester, fuller and dresser, for improvements in the dressing and getting up of hosiery goods manufactured from lamb's wool and other yarns, and in machinery for raising the nap on the same, and in the construction of legs and other forms or shapes for stockings and other articles of hosiery. March 19; six months.

Jules Thiebeauld de la Crouee, of Pinner's-court,

London, merchant, for an improved apparatus for, or method of purifying, clarifying, and refining, vegetable extracts. (Being a communication.) March 19; six months.

André Drouet de Charlien, of Sablonіere Hotel, Leicester-square, gentleman, for improvements in rails for railways, and in wheels for locomotive carriages. (Being a communication.) March 20; six months.

William Isaac Cookson, of Newcastle-upon-Tyne, esquire, for improvements in apparatus for burning sulphur in the manufacture of sulphuric acid. March 20; six months.

John Holland, Butterworth, of Rochdale, Lancaster, cotton spinner, for a certain apparatus applicable to preparation machines used in the spinning of cotton and other fibrous materials. March 20; six months.

Moses Poole, of Lincoln's-Inn, Middlesex, gent., for improvements in dyeing. (Being a communication.) March 21; six months.

John Butt, of Maldon, Essex, draper, for certain improvements in candlesticks. March 22; six months.

John Harcourt Quincey, of Old-street, City-road, gent., and John Johnston, of Cursitor-street, lamp maker, for improvements in the manufacture of lamps, and shades for lamps and other lights. (Being partly a communication.) March 25; six months.

William Pollard, of Newcastle-upon-Tyne, gentleman, for certain improvements in the manufacture of ammonia. March 28; six months.

James Hardy, of Birmingham, Warwick, gentleman, for certain improvements in the process of welding tubes, pipes, or hollow rods of malleable iron by machinery. March 28; six months.

Joseph Maudslay, of the firm of Messrs. Maudslay, Son, and Field, of Lambeth, Surrey, engineer, for certain improvements in steam-engines. March 28; six months.

Alfred Richard Johnson, of the firms of Messrs. Johnson and Co., Regent-street, and Messrs. Griffiths and Johnson, Old Bond-street, Middlesex, hatters, for certain improvements in hats. March 28; six months.

Joseph Cooper, of Hoxton, Middlesex, gentleman, for certain improvements in the purification and clarification of sugar, which improvements are also applicable to the purifying and clarifying of other articles of commerce. March 28; six months.

Robert Davison, of Brick-lane, Middlesex, civil engineer, and William Symington, of East Smithfield, Middlesex, civil engineer, for a method or methods of drying, seasoning, and hardening wood and other articles, parts of which are applicable to the desiccation of vegetable substances generally. March 28; six months.

Robert Mollett, of Shecklewell, Middlesex, gentleman, and Jesse Bridgman, of Hackney, Middlesex, gentleman, for certain improvements in separating the fatty and oily from the membranous portions of animal and vegetable substances. March 28; six months.

Charles William Spicer, of 28, Portman-square, Middlesex, esquire, for an invention called the nautilus, or portable life-preserver and swimming belt. (Being a communication.) March 28; six months.

Charles Hector Francois Dumontier, of Rouen, France, engineer, for improvements in the construction of lithographic and autographic presses. (Being a communication.) March 28; six months.

LIST OF PATENTS GRANTED FOR SCOTLAND FROM THE 26TH OF FEBRUARY TO THE 22ND OF MARCH, 1844.

William Rowan, of the firm of John Rowan and Sons, of Doagh Foundry, Antrim, engineer, for certain improvements in axles. Sealed, February 26.

Gottlieb Boccius, of New-road, Shepherd's Bush, Middlesex, gentleman, for certain improved arrangements and apparatus for the production and diffusion of light. March 5.

Thomas Murray Gladstone, of the Swan Garden Iron Works, Wolverhampton, Stafford, iron master, for certain improvements in machinery for cutting or shearing iron or other metals. March 5.

George Bennetts, of Gunnis Lake, Cornwall, civil engineer, for certain improvements in steam-engines and boilers, and in generating steam. March 8.

Edward Eyre, of Poole's Hotel, London, gentleman, for certain improvements in railways, and in the machinery or apparatus to be employed thereon. (Being a communication from abroad.) March 11.

William Edward Newton, of the Office for Patents, 66, Chancery-lane, Middlesex, civil engineer, for improvements in the preparation of caoutchouc, or India-rubber, and in manufacturing various fabrics of which caoutchouc forms a component part. (Being a communication from abroad.) March 12.

Joseph Crawhall, of Newcastle-upon-Tyne, rope manufacturer, for improvements in machinery for manufacturing ropes and cordage. March 20.

Richard Prosser, of Birmingham, Warwick, civil engineer, and Job Cutler, of Lady Poollane, near Birmingham, gentleman, for improvements in the machinery to be used in manufacturing pipes and bars, and in the application of such pipes and bars to various purposes. March 21.

Isabella Larbalastier, of Noble-street, Falcon-square, London, furrier, for improvements in making certain skins resemble the sable fur. March 22.

Henry Brown, of Selkirk, in the county of Selkirk, manfacturer, for improvements in carding silk, cotton, and other fibres. March 22.

Moses Poole, of Lincoln's-inn, Middlesex, gentleman, for improvements in steam-engines, steam-boilers, and furnaces or fireplaces. (Being a communication from abroad.) March 22.

NOTES AND NOTICES.

Joiner's Work by Machinery.—Mr. Pauling, of Manchester, well known as a successful contractor for railway works, is erecting machinery on a very extensive scale, for the purpose of executing almost every description of joiner's work, the special object being to effect the most difficult parts, such as morticing, and the making of sash frames, &c.

Niagara.—Measurements have been made of the volume of water of the Niagara river, from which it appears that "the motive power of the cataract of Niagara exceeds by nearly fortyfold all the mechanical force of water and steam power, rendered available in Great Britain, for the purpose of imparting motion to the machinery that suffices to perform the manufacturing labours for a large portion of the inhabitants of the world, including also the power applied for transporting these products by steam-boats and steam-cars, and their steam-ships of war to the remotest seas. Indeed it appears probable that the law of gravity, as established by the Creator, puts forth in this single waterfall more intense and effective energy than is necessary to move all the artificial machinery of the habitable globe."—*Silliman's Journal.*

LONDON: Printed and Published by James Bounsall, at the Mechanics' Magazine Office, No. 166, Fleet-street.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; and W. C. Campbell and Co., Hamburgh.

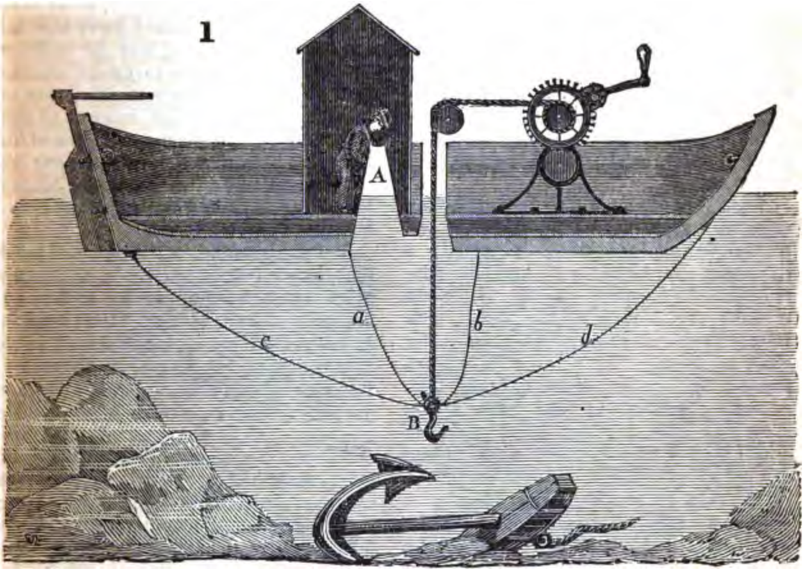
Mechanics' Magazine,

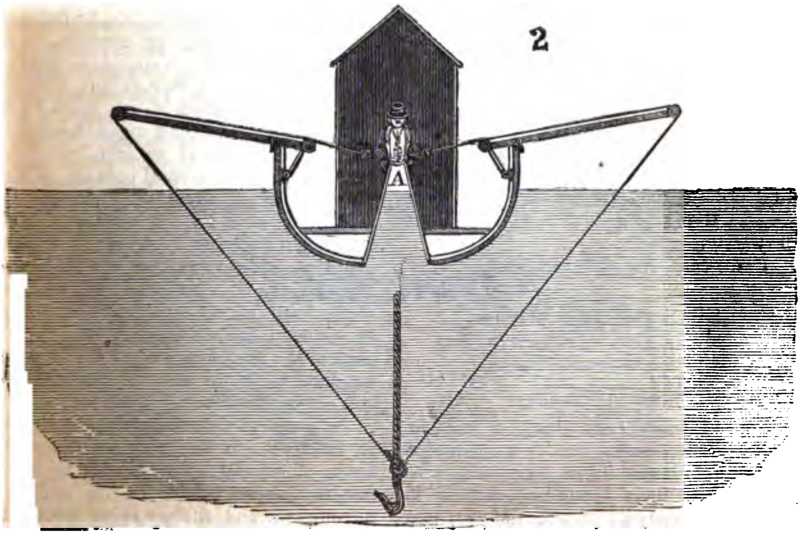
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1078.] SATURDAY, APRIL 6, 1844. [Price 3*d.*

Edited by J. C. Robertson, No. 166, Fleet-street.

SUBMARINE EXPLORING APPARATUS.





SUBMARINE EXPLORING APPARATUS.

Sir,—I take the liberty of submitting to your readers a plan of an apparatus which I think would be found generally useful, and of great consequence to all who are interested in submarine discoveries or pursuits. In clear water and bright weather it would have all the advantages of a diving bell for exploring coasts—for ascertaining the position of sunken ships and carrying out the best methods of raising them—for discovering stranded anchors or parts of wreck and picking them up—for surveying the progress of building breakwaters—in every case, in short, where it is necessary to see under water.

Figs. 1 and 2 of the accompanying sketches represent longitudinal and transverse sections of a boat with a darkened apartment in it, having a funnel-shaped opening A in it, right through the bottom of the boat. The funnel should be lined with black woollen cloth to prevent the rays of light from converging in their passage upwards. The reflecting surface of the water being destroyed, and the water being made the only medium of conveying light to the eye of an observer, he would be placed in all respects of vision the same as a man in a diving-bell suspended over the object sought for. At the same time he would have the advantage of directing a power to any particular place or object by means of four guide ropes *a*, *b*, *c*, *d*, attached to a hook B, and completely under his command. He might take in a great range by having yard-arms over the sides of the boats, and guide his hook with the utmost certainty. I have no doubt but lenses may be made and used to as great advantage in the water as in the air, and that objects may be discovered in deep clear water as far as the rays of light penetrate.

I am, Sir, your constant reader,

John Hobbs.

14, Avon Crescent, Hotwells, Bristol,
December 15, 1843.

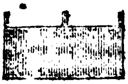
IRON BUILDINGS.

Sir,—The great abundance of iron, as well as its cheapness, render it important to find out means for its more extensive employment. As a building material it has been already adopted for the purposes of forming bridges, arches, pillars, beams, roofing and various portions of buildings. But, in this country at least, it has never been employed to any extent for the entire construction of buildings. In now suggesting it for this purpose, I am willing to admit there is no great novelty in the proposal; still, however, as far as the plans, by which I would carry this out, are concerned, there may be sufficient inventive contrivance to excite attention to the subject, and my method may not be altogether devoid of interest to those who, occupied in the manufacture of iron for general purposes, may not have had their attention drawn to the possibility of extending the consumption of iron as a building material.

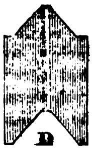
Very substantial, and fire-proof buildings, might be constructed in imitation of brick or stone, by uniting a series of *hollow* cast-iron blocks, each weighing 28 lbs. or 56 lbs. and upwards. In the accompanying engraving, A represents a side view of one of these blocks, or, more properly, frames; and B is the end of the same. C is the plan of the frame, and shows that it consists of only the two sides, ends, and a centre partition; the centre of which has a hole drilled through it, the ends being only fluted or grooved. This partition, and the ends of the blocks exactly correspond with each other, when the blocks are laid in courses; for then the two ends of adjoining blocks bring together the semi-circular grooves in the ends of the blocks, forming together a vertical aperture, which, falling over the hole in the partition of the block in the course underneath, and so on throughout the series, allows of an iron rod being passed down the several courses to bind them together, as at F, *f*, G, *g*. Or, where such rods are not employed, metal or wooden pins may be driven in to assist in giving stability to this dry built wall. D and E are enlarged views of the ends of the iron frames, showing the pointed or rounded form that may be given to each of the ends and centre partitions of the blocks, to prevent the possibility of any single block being displaced.

To keep out the weather, the frames or blocks might be jointed with several kinds of cement, or even with layers of prepared paper, felt, or the like, sufficient to complete and fill up every joint. In

such iron-built houses a recess might be left for building the fire-places and chimneys of brick. Parts of the walls

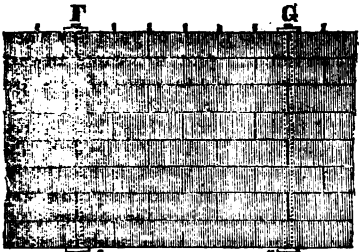


A B C




D E

F G



f g

where nails would be wanted, could have holes in the castings, plugged up with wood. As there are cements that will adhere to iron, the interiors could be plastered with such cements, and papered or painted. The ceilings would be as at present. Such houses would be quickly erected and be habitable without risk, immediately on completion. They might be built on the usual foundation, or on brick or stone: and under all circumstances would be much drier than houses in general, in damp situations. A complete circulation of air could be kept up *within* the walls, by having an external communication with the air, and an internal communication with the fire-places; or, it would be easy, on shutting off this communication, to obtain a complete -irculation of warm air through every ıll of the building, from the basement wards. In some cases it might be emed desirable to fill up the interstices th saw-dust, sand, ashes, &c.

Upon the plan now suggested it would o be possible, and often very conıient, to build large water tanks, cisns, powder-rooms, bank and office fes, chambers for steaming and other ırposes, varying only the form and dinsions of the frames or blocks.

Though the expense of the individual blocks might be greater than the price of the same measurement of brick or stone-work, yet, taken altogether, it might be found cheaper, considering the difference in time for building an iron and a stone house, with every other circumstance attendant on such improved mode of building, together with the worth of the materials, and the probability of the shell of an old house being quite suitable to remodel and form quite a different structure; the very reverse of which must happen on taking down brick or stone erections; besides, that the old iron materials would be intrinsically of more value than the usual building materials of old edifices.

Not the least comfort of such houses as are here recommended, would be their freedom from vermin; as well as the facility for a thorough fumigation, should they ever make any inroads. There are many obvious matters of detail which it would be premature to enter upon; I wish first to lay down the general principle, and if that is approved, all the rest follows readily enough. Walls, such as I have described, would be like a series of square tubes standing vertically side by side. The frames themselves may be supposed to be 18 inches long by 6 or 12 inches deep, and 6 inches broad.

Hoping that I may yet see this plan carried out practically, I am, Sir, your very obedient servant,

H. D.

Surrey, March 30, 1844.

PERCOLLANE—NEW CEMENT AND ARTIFICIAL STONE.

The Tyne Fuel Company, of whose very superior artificial fuel we lately gave an account (see *Mech. Mag.*, No. 1074, p. 174,) also manufacture from the same materials, but by a different process, a composition of a singularly adhesive character, to which they have given the appropriate name of *percollane,* and which may be used in a fluid state as a cement or coating, or in a hardened state as a material for building, or paving. The following is the description given of this new mastic in the specification of Mr. Bertram, the English patentee:—

"I take seventy parts of turf or peat as it comes from the field, and having pressed out the greater portion of the

water which it contains, mix it with thirty parts of tar or pitch, (preferring, however, coal tar.) I leave the mixture at rest for some hours, then put it into a cauldron or other suitable vessel, and keep it boiling for about three hours. The product is a cement or mastic, of a very adhesive and tenacious quality, readily soluble after it has become hardened, impervious to water and moisture, and nearly inodorous. When it is desired to use this cement for the purpose of coating ships which are liable to become foul from the adhesion of marine animals and plants, I add to each 100 parts of the peat or turf, and tar, about two parts of common yellow soap, and about ten parts of oxide of copper, or any other metallic salt of the like poisonous quality. And further, to modify the said artificial composition, so as to fit it to be employed as a substitute for stone, I diminish the quantity of peat or turf made use of to thirty-five parts, and substitute for the discarded thirty-five parts as many parts of mud and slime taken from the bottoms of rivers, canals, ponds, marshes, &c., intermixed with a little dry sand or very fine gravel. I treat this mixture precisely in the same way as that last before described, and then mould it into blocks and slabs of any required form and size. For the paving of streets, terraces, &c., this artificial stone will be found exceedingly well adapted; it is extremely hard, and not at all affected, either by heat or moisture."

COPPER BALLOONS—HINT TO AGRICULTURAL MACHINE MAKERS.

Sir,—According to Galignani's Paris Journal, " A balloon made of sheets of copper is to be seen in the *Impasse du Maine*, near the Versailles rail-road station, and an ascent is to be soon attempted." Seeing then that our scientific neighbours, the French, are profiting by my suggestions about metal balloons given at page 24, vol. xxxix. of your Magazine, and which I am well pleased to see, I would crave your indulgence to communicate another suggestion that may be useful to our agricultural machine makers, arising out of the following paragraph, which has recently appeared in some of the London journals:—

" At a soirée of the Royal Society held at the Marquis of Northampton's, a sample of wheat was shown in the front drawing-room, grown at Horsham, Surrey, which interested a large circle of the visitors. Mr. C. Dickens, brother-in-law of the noble president, stated that an experiment had been tried on land not previously dressed and manured, in the production of wheat, planted in single corns, in rows 6 inches apart, 'dibbled' several inches in the ground,—nine, if we mistake not. The result was most successful, each corn producing, on an average, from 20 to 25 ears,* but there were instances of 40 ears. Six acres were set apart for the experiment, and the produce was an average of 17 sacks to each acre."

Having previously ascertained that it will take 10,600 grains of good dry wheat to fill an imperial pint, it became an easy task to ascertain the measure of seed per acre, used in the above experiment, which I find amount to 16½ pints nearly. The quantity of seed wheat used by the farmers generally, varies from 100 to 200 pints per acre, and they are well provided with machines for sowing these variable quantities. Well content would they be, too, to get half "17 sacks per acre." I think, however, it is not at all improbable, that after another successful experiment or two in thin seeding, the machine makers may be called upon for the production of machines adapted to the drilling or dibbling small quantities of seed; if so, perhaps the following calculations may prove of some little service.

If wheat be sown in drills 7½ inches, 6 inches, or 5 inches apart, the total length of drills upon an acre will be respectively 13·2 miles, 16½ miles, and 19·8 miles; and if the seed be one imperial peck per acre, the distances of the grain in the drills will be in the first case 4·93 inches; in the second, 6·164 inches; and in the third case, 7·31. If two pecks of seed per acre, the distances will very clearly be the halves of these numbers; and generally, the distances of the grains in the drills will be in the inverse ratio of the number of pecks of seed per acre.

I would observe, in conclusion, that farther experiments in regard to a more judicious distribution of seed corn upon the

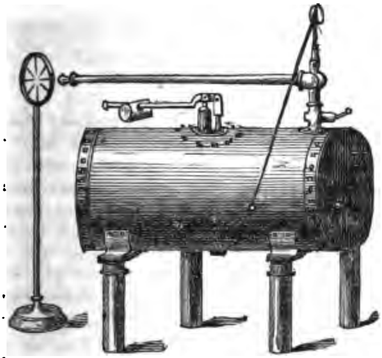
* On a careful investigation of this case, I am led to believe that there is some mistake about " each corn producing on an average from 20 to 25 ears." I find that 8 ears of 33 grains each to every corn sown, would be quite sufficient for the production of 17 (sacks) coombs per acre.

land are very desirable. But such experiments cannot be successfully prosecuted without the aid of the skilful and ingenious mechanic.

Yours truly,
J. Loose.

Wolverton, March 26, 1844.

PORTABLE HYDRO-ELECTRIC MACHINES. BY CHARLES V. WALKER, ESQ., EDITOR OF THE "ELECTRICAL MAGAZINE," (NO. IV., FOR APRIL.)



There are several forms which have been given to the portable hydro-electric machines. The first to which we may allude is one constructed by Watson and Lambert, for Mr. Addams, the action of which was exhibited last summer before the members of the United Service Institution; and the power of which we have ourselves had the opportunity of testing with Mr. Addams. It consists of a cylindrical boiler 30 in. by 16 in. Five tubes, in a lower row of three, and an upper row of four, traverse the boiler longitudinally. The boiler rests on a frame supported by four glass pillars. Before being placed in the frame, the steam is "got up," by means of an open furnace of a suitable shape; the steam is then "kept up" by a succession of iron heaters, each 15 inches long, which are thrust into the tubes just alluded to; the heaters being prepared in the furnace, after it is vacated by the boiler. A convex cover, applied to each end of the boiler after the heaters are in, gives the requisite rounded form. One end of the boiler is furnished with a gauge water-cock and a steam-cock. The boiler also possesses a safety-valve, which is adjusted as high as 90 lbs. Above the boiler rises a short tube furnished with a stop-cock; it enters an inverted hemispherical metal vessel, in which the requisite condensation occurs; from this the hydrated steam escapes through a tube, furnished with the usual box-wood jet. Mr. Addams obtains the electricity of the steam itself, by allowing it to blow through an insulated hollow metal cylinder, furnished within with wire gauze or metal points. The spark from the boiler is 10 or 12 inches long.

Mr. Gassiot has a small machine, made under his direction, of a metal globe of the capacity of two gallons; a globe, which was a gas-holder, in the days of portable gas, and which can therefore bear a high pressure. The steam-tube rises from the top, and curves off at right angles; the jets are fitted up in the usual way. The globe is placed on a small metal tripod, beneath which is a chafing-dish containing charcoal; the whole stands on a square tile, supported by four glass pillars. When in good action, and by careful management, an attenuated spark of an inch may be obtained. Mr. Gassiot exhibited this instrument, and Dr. Pereira exhibited another, constructed after the same model, at the Soirée of the London Institution held on January 17th last.

The prefixed engraving represents an elegant machine by Messrs. Watkins and Hill, the general construction of which corresponds with that of the one we first described. The rod, resting on the front of the machine, is a means for conveying the electricity to any piece of apparatus. The circle of converging points, for de-electrizing the steam, was adopted at our suggestion, in place of a mere fork. This machine will charge 70 feet of coated surface in a minute, with 20 grs. on the balance discharger.

We learn from Mr. Armstrong that very great improvements are continuing to be made in the construction of these machines. He speaks of one "capable of charging 110 square feet of coated surface in a minute, to 20 grs. of Cuthbertson's Electrometer, and yet it only discharges as much steam as three of the jets belonging to the great machine at the Polytechnic." The great improvements appear to consist in having been able more duly to adjust the degree of condensation to the size of the jets. More suitable specimens of partridge-wood have also been obtained. Mr. Armstrong also mentions that the manufacturers are endeavouring to make some which shall be heated by naphtha lamps. One objection which may present itself against the use of these machines in a room, is the quantity of steam liberated; but this may easily be carried off by blowing the steam towards a fire, when it will ascend the flue. On the whole, it appears more than probable that the power of these machines may be eventually so modified and exalted, as that they may hold an equal, perhaps a superior rank, to the ofttimes troublesome instrument (for a lecturer especially)—the frictional machine.

PROGRESS OF ELECTRICITY AS A MOVING POWER.

[Extract from a letter from Mr. Lettsom to Mr. Weeks, and communicated by the latter to Mr. C. V. Walker, Editor of the *Electrical Magazine*.]

Sometime since, I sent, through your hands, to the London Electrical Society, a short notice, translated from the *Augsburg Gazette*, to the effect that Wagner, of Frankfort-on-the-Main, had very nearly completed his electro-magnetic carriage. The same paper now announces, Dec. 3rd, 1843, (and the correspondent gives his name, Beil,) that the carriage is now complete, and only awaits the examination of the commission to be named by the German Diet. The arrangement appears to be capable of great power, for the carriage, (with machinery producing the motion and the battery,) weighs a ton and a-half. The description is very incomplete: but from what is said of the carriage being mounted "on ordinary railroad wheels," it appears not to be destined for use on common roads. The battery consists of twenty pairs of copper and zink plates. Mr. Beil says, experiments have already shown that the arrangement has sufficient power to propel, with the greatest facility, the carriage containing from thirty to forty persons. Nothing is said of the velocity attained in these experiments. By this time twelvemonth the affair will, I suppose, be settled one way or the other.

A Berlin paper, dated about the 29th of November last, contains a letter to the following effect:—"Bauer of Nuremberg at present shows a machine, which convinces all those who see it, that the magnetic force may be carried to any extent that is desired. The machine is of peculiar construction:—attached to an upright iron spindle, there is a wheel of the same metal; below there are numerous moveable magnets having motion imparted to them by a large magnet. The method of inverting the poles is quite original, being totally different from the method of Jacobi. The battery—which, however, one does not see—must be of great energy. The wheel preserves an uniform velocity of motion. The machine is employed in pounding spices, and it is well finished, and strong in all its parts."

THE DISCOVERY OF ELECTROGRAPHY, AND MR. SPENCER.

Sir,—On reading Mr. Spencer's letter in your Number of 16th instant, my first impression was to treat his observations as utterly unworthy of notice, it seeming to be his object to write upon anything but the question at issue. On further reflection, I consider it may be worth while not to leave the subject quite in the unsettled state into which Mr. Spencer has contrived to throw it. Writing to you, 27th February, he pretends to believe I am going to republish my papers "in all probability in the shape of a pamphlet," and thereon he makes a proposal, intended to act (as he says) "as a sort of wholesome check," p. 143.

In my reply, 4th March, I say distinctly in alluding to the above, "Mr. Spencer sadly misunderstands me in my concluding remarks, in supposing I intend publishing a pamphlet on the present, to him, all-important discussion," p. 173. Having thus clearly disclaimed all such intention of a pamphlet, it was not likely I could suppose that the "wholesome check" was to remain independent of every other consideration.

Mr. Spencer, however, now says,—"And what was the gist of the proposed terms? That after Mr. Dircks had fully made his charge, I should reply,—then submit both cases, after having been printed, to a competent committee, and whatever decision they came to, I should feel myself bound to abide by it,—*and this is not accepted!*" Mr. Spencer puts this very triumphantly, but, with the foregoing explanation, it will be perceived that he is only shifting ground, and making his terms general, which, originally, were only meant to apply in the event of my publishing my papers in the form of a pamphlet: a very gratuitous suggestion of his own.

To prevent all further cavil or misunderstanding, I now beg to state that I have made, and consider I have, too, fully substantiated, my charge of plagiarism and want of originality; and I am quite as willing as Mr. Spencer to abide by the decision of any committee competent to decide the question as to whether he is or is not the inventor of the electrotype process.

I am, Sir,
Your obedient servant,
HENRY DIRCKS.

77, King William-street, City,
March 29, 1844.

SCREW-PROPELLING.

We quote the following paragraph from the *Times*:—

"THE PHŒNIX STEAMER.—The Lords Commissioners of the Admiralty have ordered this frigate to be fitted with Mr. Steinman's submarine propeller, which has already been successfully tried in Her Majesty's steamers *Bee* and *Dwarf*, and with new engines of 260 horse-power. The *Phœnix* is the first war-steamer fitted by

the Admiralty with a screw, if we except the *Rattler* (200 horse-power), built for experiments, and has been placed at Mr. Steinman's disposal in consideration of his propeller having surpassed in speed those of Mr. Smith ('the Archimedean screw') and Captain Ericsson in the late trials, conducted by the Admiralty, in the *Bee*. The speed of the *Dwarf* when tried with this same propeller at the measured mile was 12·139 miles, which is the greatest result yet obtained by a screw."

This is a very mystifying paragraph; containing *possibly* nothing but what is substantially true, yet presenting it in a way very much calculated to blind and mislead the reader. The real facts are simply these. The submarine propeller here called "Mr. Steinman's," is that patented by Mr. Blaxland, and better known as his,—Mr. Steinman being part proprietor of the patent only. When this propeller was tried in the government experimental vessel, the *Bee*, it gave a higher rate of speed than either Smith's or Ericsson's. The writer of the paragraph states that "the speed of the *Dwarf* when tried *with this same propeller* was 12·139 miles, which is the greatest result yet obtained by a screw;" but Messrs. Rennie, who fitted out the *Dwarf*, originally called the *Mermaid*, and after they had realized the speed of 12·139 miles, sold her to Government, say that it was not Mr. Blaxland's propeller, with which they obtained that result, but an entirely different one of their own construction. While this point, therefore, remains as it were *adhuc sub judice*, it can hardly be considered fair in the writer of the paragraph, to treat it as one quite decided in favour of Mr. Steinman. Who has decided so, Mr. Steinman himself, or who else?

DEPOSIT OF GOLD RECENTLY DISCOVERED IN THE URAL MOUNTAINS.

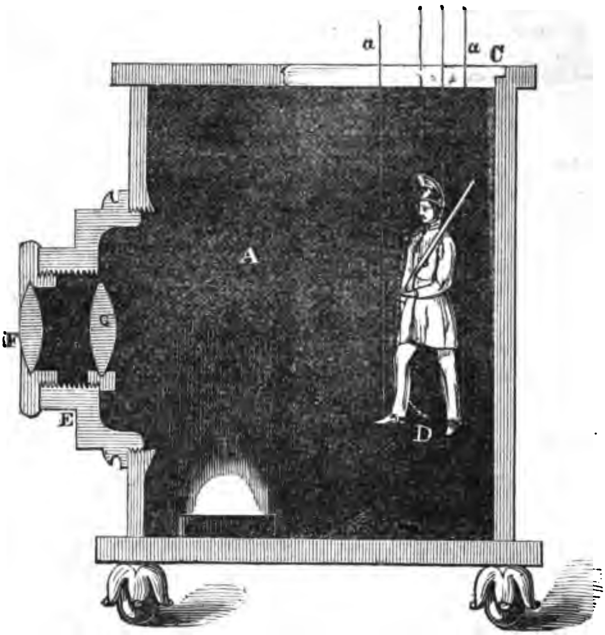
[Extract of a letter from M. de Kokcharoff, officer the Royal Mining Company, to M. de Humboldt. Translated from the *Annales des Mines*.]

The mass of gold recently discovered in the Ural is the largest known in the whole world. It was found in the gold-bearing sands of Miask, in the district of Zlatooust, not far from the celebrated mines of Tzarevo Nikolæfsk, and of Tzarevo Alexandrofsk, in the southern Ural. These two mines have already yielded, as you are aware, nearly 400 pouds of gold (6552 kil.), equal to about 17,544·5 lbs.—and, more than once, very remarkable masses have been collected there; thus, in 1825, they found there the specimen weighing 24 phounds 68 zolotniks (10 kil. 118) about 27·017 lbs. These mines beginning to fail, explorations were made near the river Tachkou-Targanka. A very rich but circumscribed bed being found, the stream itself was turned, and its channel examined. They came at once upon a stratum of gold-bearing sands of considerable extent, where the yield of gold was 100 pouds to 8 zolotniks (a very great proportion, when it is remembered that sands giving 100 pouds to 1½ zolotniks have been before considered well worth exploring); then other beds were discovered, of a yet greater capacity, which led to the examination of the whole valley of the Tachkou-Targanka, with the exception of the spot occupied by the buildings necessary for the washings. In the course of 1842 they pushed the works under the foundations of the building; the first attempts were not successful, but they soon came upon a spot of marvellous richness, where the yield was from 50 to 70 zolotniks of gold in one poud of sand; its extent, however, was very limited. At last, on the 26th of October, 1842, they found this monstrous mass, weighing 2 pouds 7 phounds 92 zolotniks (36 kil. ·020758), 100·078 lbs. It lay upon the strata of diorite (a variety of trap) in the bed of gold sand, at the depth of 4½ archines from the surface, and under the corner of the building. The mass in question has already reached St. Petersburgh, and is placed at the museum of the Institute of Mining Engineers. A discovery which is equally worthy of our attention, is that of a bed of gold-bearing sands on the left bank of the same river before the dike, containing a considerable number of masses; already they have taken thence 52, weighing each from 1 lb. to 7 lbs. Russian.

Note by M. Humboldt.—The largest piece of platina found, up to this time, at Nijni Tageulsg, weighs 23 lbs. (Russian) 34 zolotniks. Piece of gold found at Miask, 10 kil. ·119 = 27·002 lbs. Piece of gold found in the United States, Anson County, N. C., 21·70 kil. = 57·939 lbs. Piece found at Rio Hayna (1502), and lost in the depths of the sea (*see* my critical examination of the geography of the new continent), 14·500 kil. = 38·715 lbs. Wonderful mass of miask found 1842, 36·020 kil. = 100·077 lbs.

According to a letter from Count Cancrine, Dec. 3, 1842, Siberia, to the east of the Ural, produced, in 1842, the quantity of 479 pouds of gold = 7·846 kil. = 21,058 lbs., and the whole of Russia about 970 pouds 15·889 kil. = 42,323·63 lbs.

DESCRIPTION OF THE SPECTROSCOPE, A NEW INSTRUMENT FOR EXHIBITING SUPERNATURAL APPEARANCES, ETC.



Sir,—The above drawing represents the internal structure of an instrument, devised by me, for producing such supernatural appearances as skeletons, wraiths, &c. on the semi-transparent parts of a dramatic scene, as, for instance, on the "sky" of a landscape, the window of a hall or chamber, or the "impenetrable gloom" portion, in the centre of some haunted cavern, or witches' cave.

A is a square wooden box of about 2 feet 6 inches each way; it has an opening C, to which can be fitted the perforated lid; the holes in the latter are to allow the strings *a*, *a*, *a*, that work the automaton D, to pass through from thence to a wooden cross held in the hand of the exhibitor. E is a brass-piece, to which two convex lenses F and G are screwed; the compound focus of which ought to be about 2 feet. H is an iron tray, on which an ounce, or thereabouts, of the chemical mixture called "Bengal fire" is placed, a similar arrangement being made on the opposite side of the con... it is desired to put the instrument into action, it is drawn to such a distance from and behind the scene, that the image of the figure D may fall thereon and be shown distinctly; the stage is then darkened, either progressively or suddenly, and the moment the Bengal lights are lit the apparition will become visible to the spectators, producing quite a novel and peculiar effect, as the image has altogether a different aspect from any of those produced by magic lanterns or phantasmagorias; all of the latter having the appearance of mere superficial painted pictures, or transparent paintings, while the spectroscope one resembles, in every point, a solid object, the projections, indentions, and shadows of the limbs, drapery, &c., being strictly those observed in nature, which gives it a very mysterious reality under the circumstances in which it is seen. The effect may be still further heightened by applying to the instrument the principle of the phantasmagoria, that is, the power of apparently projecting the images among the spectators. The emergence of a skeleton forms an admirable subject, and by fantastically

moving its bones during the period of its dilatation, the effect is terrific in the extreme.

All the figures ought to be painted with white-lead mixed with very thin size, in order that as much light may be reflected therefrom as possible; and the inside of the box should be covered with black velvet to prevent any false glare.

The Bengal fire mentioned above, is composed of purified nitre, 8 ounces; brimstone, 3½ ounces, red sulphuret of arsenic, 2 ounces, all ground together in a mortar to a very fine powder, and afterwards put into a bottle, to preserve it from the air and moisture.

Sir, I have the honour to be, your obedient servant,

T. W. NAYLOR.

Newcastle-upon-Tyne, February 30.

WEALE'S QUARTERLY PAPERS ON ENGINEERING. PART III. LADY DAY, 1844.

The contents of the present part of this spirited and meritorious publication are, I. A translation, very well done, of M. Mallet's approbatory Report to the French Board of Works on "the Railroad constructed from Kingstown to Dalkey upon the Atmospheric System, and upon the application of this System to Railroads in General;" illustrated by four plates. II. Sketch of a Novel Mode of Applying the Atmospheric Pressure to Railways, by means of Pneumatic Locomotive Engines. By Joseph Gill. III. Memoir of Mr. Samuel Clegg, C.E., the Author of the Atmospheric System and Father of the Gas Manufacture—some extracts from which we subjoin. IV. The commencement of a Translation of Peclet's Treatise on Heat, "2nd Edition;" a two vol[u]me work,—which though eminently des[er]ving of being rendered into English, see[m]s rather out of place in a collection of "P[a]pers" like this. V. Specification of a 25 [Ho]rse-power Engine, and Dredging Machi[ne]ry, constructed by Messrs. Bury, Cu[rti]s, and Kennedy, for deepening the Bay of [S]antander in Spain, with five plates. VI. The Harbours of the South Eastern Coa[st]. By W. Mullingar Higgins, C.E. VII. The Restoration of the Herne Bay Pier. By W. Mullingar Higgins, C.E., with two plates. And VIII. Examples of Engineering in the United States of America; No. 1 being a description of an Hydraulic Dock, lately erected on the East side of the New York, or Long Island Sound.

The Memoir of our excellent friend Mr. Clegg does not furnish much new information, in addition to what is contained in the Treatise on Gas Lighting of Mr. Clegg, Junior, which we reviewed at length in our Journal of the 21st May, 1842; but it is very agreeably written, and in a spirit of commendation which has our hearty concurrence. On one point, however, the writer has gone rather further than the truth will warrant. Although the water gas-meter is undoubtedly the invention of Mr. Clegg, it is a mistake to say that it has undergone no improvement since it came out of his hands twenty-five years ago. On the contrary, it has been much improved, as well as by Mr. Clegg himself, as by others. We subjoin the principal passages of the Memoir.

The subject of this memoir is an engineer whose name is extensively known throughout Europe in connexion with two grand discoveries, which have never been surpassed in the influence they are calculated to exert upon the world at large. The first of these is the production of artificial light from the distillation of coal; an application of chemical science and mechanical skill which, under the name of the GAS LIGHT, is now familiar to every one. The other, which is an application of steam power to the purposes of railway transit, brings into operation on a grand scale the great natural power which resides in the atmosphere with which we are surrounded, and up to this time has realized a result equal to the most sanguine anticipations entertained by the friends of the ATMOSPHERIC RAILWAY.

Mr. Clegg was born on the 2nd of March, 1781, and his early years were passed in the great engine factory established by Messrs. Boulton and Watt, at Soho, near Birmingham. In this famous school of mechanical engineering, surrounded by the most brilliant applications and combinations of genius, industry, and skill, favoured also by daily intercourse with some of the most distinguished mechanicians and chemists of the day, it was no wonder that Mr. Clegg imbibed an ardent spirit of mechanical inve[n]tion, and sought,

even at an early period of his life, for some particular department of industry in which he could exercise his power of judgment, and display the inventive faculties of his mind. It is indeed impossible to imagine a scene more calculated to arouse and stimulate the energies of a youthful genius, than that displayed by the great workshop towards which the eyes of all the philosophers and men of science throughout Europe were directed, in confident anticipation of the incredible moral and physical changes to be wrought in future times, by means of that mighty element of power which the steam-engine was now extensively displaying to the wonder and admiration of the world.

Already the master spirits of the age began to recognize in steam an agent of civilization, and a bond of national intercourse far more potent than the world had ever before seen;—already the steam-engine produced from the workshops of Soho was draining the mines of Cornwall and raising its ores—drawing from the earth that very coal whose combustion reproduces the power expended with accumulated interest—already in imagination she was ploughing the waves of the ocean—extending the dominion of civilized man, and floating on the bosom of magnificent rivers in the New World;—already it was hinted that steam was one day entirely to supersede the winds in giving motion to the sails of ships upon the waters, and of mills upon the land—and vague and fanciful allusions were even then common to the possibility of land transit being carried on by steam, and communications being made between distant places with the speed of the whirlwind and the regularity of clockwork.

It might well be expected that in the very centre and pivot around which were congregated the elements and parts of all these glowing and brilliant thoughts, the mind of an active industrious youth should be fired with the thirst of discovery, and should look around in search of a path on which to enter in the hope of acquiring distinction.

In recalling, after the lapse of nearly half a century, the position occupied by young Clegg in the great manufactory of Soho, we shall be at no loss to discover the practical and material considerations which must have impressed upon his mind the high value of the volatile products driven off by heat during the combustion of fossil fuel. The steam engines by which he was surrounded, and of which he was constantly hearing, were consuming vast quantities of pit coal, and even at that early period the laws of combustion were attracting attention, and amongst these, the nature of the gases resulting from the decomposition of coal, claimed in a high degree the consideration of philosophers, and aroused the attention of the practical chemist and mechanic.

Besides this, during the apprenticeship of young Clegg, the engine of Boulton and Watt was creating an immense revolution in the iron trade of the whole world. Our iron masters were everywhere availing themselves of its extraordinary powers, in order to produce a blast sufficiently strong for the purpose of smelting the ore with pit coal instead of charcoal. In preparing pit coal for the blast furnaces by means of the process of coking, vast quantities of gas are driven off: and at a time when the iron trade was under the extraordinary impulse produced by the introduction of steam, it is natural to suppose that the gas driven off during this process, would come under the observation of practical men, and suggest plans for its application to useful purposes.

Accordingly we find that the late Mr. William Murdoch, a celebrated mechanical engineer, subsequently connected with Boulton and Watt's establishment, actually made use of gas for the purpose of lighting, in the year 1792. Mr. Murdoch was then living at Redruth, in Cornwall, and his house being at some distance from the mines where he was engaged, he was in the habit of filling a bladder with coal gas, and of igniting a jet of it, which he suffered to escape through a small orifice in a metal tube fixed in the neck of the bladder. Mr. Murdoch commonly made use of this portable gas lamp, for the purpose of lighting his way home at night, and so novel and extraordinary did this mode of illumination appear to the country people, that its author was suspected of practising the arts of a magician, in order to produce so wonderful a phenomenon.*

About six years afterwards we find Mr. Murdoch erecting an apparatus for lighting with gas the manufactory of Messrs. Boulton, and Watt, at Soho. Between this time and 1802, when a large gas lamp, termed a Bengal light, was publicly exhibited at the end of the Soho manufactory, Mr. Murdoch made numerous experiments on the methods of purifying the gas, in which, however, he does not appear to have perfectly succeeded.

From 1802 to 1805, the gas lighting apparatus was gradually extended from one part to another of Messrs. Boulton and Watt's factory, and during all this time Mr. Clegg was a close observer of Mr. Murdoch's contrivances, and an ingenious assistant in his labours.

The results elicited by the apparatus erected at Soho being now sufficiently conclusive to

* Clegg's Treatise on Coal Gas. London. 4to. 1841.

shew the economy of the new light, and its great superiority being evident to all, several large mill owners became desirous of substituting the gas light for the expensive, troublesome, and dangerous method of lighting by candles, according to the practice of that day. Accordingly, in the year 1805, we find Mr. Murdoch erecting an extensive gas apparatus for lighting the cotton mills of Messrs. Phillips and Lee, at Manchester; while his pupil, Mr. Clegg, was similarly engaged for Mr. Henry Lodge, in lighting his cotton mill at Sowerby Bridge, near Halifax. It appears from Mr. Clegg's journal, that the mill at Halifax was lighted with gas about a fortnight before that with which Mr. Murdoch was occupied at Manchester.*

In a paper by Mr. Murdoch, which was communicated by Sir Joseph Banks to the Royal Society in 1805, it is stated that in Messrs. Phillips and Lee's mill there are 271 argand burners, and 633 cockspurs, giving a light equal to more than 2000 mould candles, of six to the pound. He estimates the annual expense of lighting this establishment with candles at £2000 per annum, while the cost of the gas lighting, including interest on capital, wear and tear, and every other expense, does not exceed 600*l.* per annum.

Up to this time, it seems that the methods adopted for purifying the gas were exceedingly imperfect, the tar being collected in siphons attached to the pipes used for conveying the gas. It was not, in fact, till the introduction of lime as a purifier, that gas can be said to have been adapted for burning in the apartments of houses. This subject of purification engaged the attention of Mr. Clegg at an early period, and about the year 1807, in lighting the manufactory of Mr. Harris, at Coventry, he introduced lime into the tank of the gasometer, and this lime being put in motion by an agitator, was prevented from settling to the bottom, so that it served in some degree to purify the gas which passed through it, by combining with the sulphuretted hydrogen, the most offensive impurity contained in the gas, and at the same time the most difficult to get rid of. This method of purifying was very objectionable, however, on account of the trouble and difficulty of removing the saturated lime. In 1808, Mr. Clegg adopted at the Catholic College of Stonyhurst, in Lancashire, a separate vessel containing lime water, through which the gas was passed before entering the gasometer; and this contrivance answered so effectually as entirely to deprive the gas of its sulphuretted hydrogen, notwithstanding the assertions of Dr. Henry, to the effect that gas was incapable of being purified on the large scale by passing through lime water. Having been invited however, by Mr. Clegg, to test the gas produced by the apparatus at Stonyhurst, he acknowledged that the process was perfectly satisfactory, and capable of being adopted in large manufactories. Soon afterwards, Messrs. Boulton and Watt erected a lime purifier at Soho, and since that time no gas work has been considered complete without either a purifier containing lime water, or one consisting of several layers of dry slaked lime, through which the gas is passed for the purpose of separating its sulphuretted hydrogen. The other impurities of the gas, such as the ammoniacal and bituminous vapours, are separated by condensation, when they assume the forms of tar and ammoniacal liquor, and pass off into a cistern placed on a low level to receive them.

For several years after this, 1809-12, Mr. Clegg was actively engaged in erecting gas works for numerous large cotton mills and factories in Lancashire. In that of Mr. Greenaway, at Manchester, Mr. Clegg first introduced the hydraulic main, which is a long cast-iron tube, commonly about 18 inches diameter in large works. This tube extends the whole length of the retort-houses in front of the retorts, with which it is connected by means of siphon-pipes. The hydraulic main is half filled with tar, into which the ends of the siphon-pipes dip, and the gas passes through the hydraulic main above the tar into another smaller tube which conducts it to the condensers.

So early as the year 1809, a company was formed in London, under the name of the London and Westminster Chartered Gas Light and Coke Company, for the purpose of supplying gas for public and private illumination. The success of this company, however, was impeded for several years by the inefficiency of the persons who undertook, in the first instance, to erect their works. It was not in fact till 1813, when they engaged the services of Mr. Clegg, that the works were undertaken with any prospect of success. For several years after their establishment, the proprietors of these works had to contend with every species of prejudice, and opposition. So great was the difficulty of introducing it into common use, that for several years this company was in the habit of fitting up and supplying shops with gas free of all expense, in order to show its superiority to the public.

In 1814, Westminster Bridge was lighted with gas, and in the same year the old oil lamps in the streets of St. Margaret's, Westminster, were removed, and the parish en-

* Clegg's Treatise on Coal Gas.

tered into a contract for having the streets lighted with gas. The history of gas lighting at this period teems with innumerable instances of the absurd and fanciful conceits and prejudices which are invariably roused by all great discoveries of this kind. Crowds of people followed the lamplighter in his daily rounds, to watch the sudden effect of his flame applied to an invisible stream, issuing from a minute orifice a thousand yards distant from the source of its supply. In some instances the lamplighters became indignant, and refused to have any thing to do with lighting an element which appeared so completely beyond their control, and so entirely different from the homely apparatus to which they were accustomed. There were some who obstinately persisted in believing, against the evidence of their senses, that the pipes through which the gas passed must be hot, and more architects than one took the precaution of directing that they should be so conducted through the walls of buildings as to be beyond contact with any combustible substance. Nor were these and similar prejudices confined only to the ignorant, and to those who, in the absence of any acquaintance with physical science, could scarcely be expected to know better. Some of the most distinguished scientific men of the day are reported to have used expressions, and to have started objections, which would be laughed at as ridiculous, by any child who has ever received an hour's instruction on the subject of gas. A president of the Royal Society considered the idea of lighting a town with gas so visionary, that he asked in ridicule "if it were intended to take the dome of St. Paul's for a gasometer?" Another president of the Royal Society, at the head of a deputation consisting of many fellows of that learned body, visited on one occasion the gas works in Peter-street, and in the presence of Mr. Clegg were speculating upon the dreadful consequences of even ever so small a leak in the gasometer, supposing a light to come in contact with the escaping gas. Mr. Clegg, with great readiness and wit, adopted the very best means of dispelling the cloudy dubitations of this learned body. Calling out for a pickaxe and candle, he instantly struck a hole in the side of the gasometer, and immediately applied the light to the jet of gas which escaped. Most of the deputation quickly retreated, and were greatly astonished when they found that the flame of gas went on quietly burning, and that no explosion took place. It is said that notwithstanding the practical *argumentum ad hominem* embodied in this experiment, the deputation went home and reported in such a strain, that the company was put to considerable expense in surrounding their gasometers with strong buildings, and also in making the gasometers of so small a size that they became very expensive.

Notwithstanding, however, all the opposition and prejudice alike of the learned and the unlearned, the great discovery with which the subject of this memoir was so intimately identified, continued to advance in general estimation, each year witnessing its gradual extension, not only from one part of the metropolis to another, but through every city and almost every town in Great Britain.

At the present time there are eighteen public gas works in London and its suburbs alone. The capital employed in these works is nearly three millions sterling, and the revenue which they yield is about 350,000*l.* per annum.

To follow Mr. Clegg through all the inventions and contrivances which he has introduced into the machinery connected with gas, would require a notice of almost every gas establishment in the kingdom, and would far exceed the limits assignable to this memoir. There is scarcely a gas work in Great Britain which does not contain some peculiar contrivance highly creditable to his talents, and worthy of being noticed in a more detailed inquiry.

One of the most successful and generally applied of Mr. Clegg's contrivances is the gas water meter, which he patented in the year 1815. This simple and yet highly efficient machine for indicating the quantity of gas consumed by any number of lights, and which consequently enables the gas companies to charge their consumers for the exact quantity of gas which they burn, is now so common and so generally understood as not to require any description. It may be noticed, however, that so perfect was the machine when first contrived by Mr. Clegg, nearly thirty years ago, that up to the present time it has received no improvement, and is still constructed in the same form as at first. Mr. Clegg sold the patent of this invention to Messrs. Crossley, who have realized a large fortune by means of it.

In addition to the water meter so generally used in this country, Mr. Clegg has patented a dry gas meter, which is much used in Paris, and is said to possess some advantages over the other.

Mr. Clegg's patent of 1815 included the description of a governor, which has since been extensively used for regulating the flow of gas from the gasometers to the street mains.

We come now to the second great subject towards which Mr. Clegg's abilities have been directed, namely, the application of atmospheric pressure to the propulsion of

carriages on iron railways. We have no longer to speak about this method of working railways in a theoretical sense, or to rest its claims to consideration upon the experiments of a model, or the arguments of a lecture-room: for many months the system has been in daily operation with the most distinguished success; and although working under very disadvantageous circumstances, it may be safely asserted, that scarcely one impartial or disinterested person has witnessed the power and regularity of the principle of atmospheric pressure so applied, without a strong impression of its superiority, in that situation, to the complicated and most destructive system of working by means of locomotive engines. We shall be understood here as alluding to the steep incline, worked by atmospheric pressure, between Kingstown and Dalkey,—a continuation of the Dublin and Kingstown railway.

Many able and well-qualified judges, who have visited Ireland with prejudices against the atmospheric system, have had their views completely changed, and whatever may be the opinion of some with respect to its applicability in every case of railways, one and all concur in admitting the superiority of the system applied to a short line like the one at Dalkey, particularly one with gradients which are not fairly workable by locomotive engines. Several eminent engineers in this country, have resolved to carry the principle into practice on the first opportunity afforded by a new line, in which they can obtain the necessary concurrence of their directors; and the envoys of Austria, France, and other continental states, have all strongly recommended the new system to their respective governments.

As the patent for the atmospheric railway is taken out by Mr. Clegg in conjunction with Mr. Samuda, of Southwark Bridge Iron Works, it will naturally be asked whether the latter gentleman was jointly inventor as well as joint patentee with Mr. Clegg. We believe the answer is, that Mr. Samuda has considerably added to the perfection of some of the details; but that the proportions of the tube, the form of valve, and the contrivances connected with it for op ning, closing, and sealing, are all origin-al due to Mr. Clegg. His talented and ze ous partner has been of essential service in ringing the system into notice, and, in th commercial transactions connected with th supplying of the apparatus to the Kings-to n Railway Company, has given the most ur ualified satisfaction to all the officers of th the company. The highly respected engi-ne r of the railway company speaks in the hi est terms of the business-like and st ghtforward manner in which Mr. Samuda executed his contract for laying down the Dalkey line; a recommendation which forms a sufficient guarantee against the possibility of unjust and exorbitant claims for extra work, in the case of any new company contracting with the patentees for laying down an atmospheric railway.

Such is a brief outline of Mr. Clegg's share in the two grand discoveries of lighting by gas, and working railways by atmospheric power. The former of these is everywhere established with unqualified success, and its advantages over all other methods of illumination are almost everywhere acknowledged. The other discovery has yet to contend with the opposition of interested and prejudiced individuals, and its promoters will have to struggle for some time against a strong array of talent and influence, banded together by common interest in the present system of working by locomotive engines.

In addition to Mr. Clegg's more regular occupation as an engineer of gas establishments, in which capacity he erected a great many of the most efficient works in this kingdom, the whole of his active career is remarkable for the number and variety of his inventions and mechanical contrivances, most of which related either to the manufacture of gas, or to some improvements in the steam-engine. He is the inventor in particular of a rotary engine which bears his name, but has not been brought into extensive use.

In concluding this notice, there is much satisfaction in being able to state that the subject of it is still living, and in expressing a hope that he may long continue to enjoy the fruits of his active and useful labours.

ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

William Edward Newton, of Chancery-lane, C.E., *for certain improvements in the construction of boxes for axles or axletrees of locomotive engines and carriages, and for the bearings or journals of machinery in general, and also for improvements in the oiling or lubricating the same.* (A Communication.) Patent dated, May 15; Specification enrolled, November 15, 1843.

The object of the first part of the invention is to gain the advantages known to result from the use, in bearings, of metallic alloys which have tin for their basis, without incurring the inconveniences arising from their weakness, and their tendency to spread under pressure. The box is to be composed of any metal which will admit of its surface

being tinned; the recess which is to receive the alloy immediately surrounds the space to be occupied by the shaft, and is bounded at each side of the pedestal by a rim which nearly touches the shaft. The surface of the recess thus formed is to be cleaned and tinned; a core is to be inserted which exactly represents the shaft, and the recess is to be filled with the alloy in a state of fusion; the thickness of the alloy being about $\frac{1}{32}$ of an inch. The method is applicable to bearings for axles, shafts, stems, or slides, having rotary, rectilinear, or other motion. In the case of bearings which have shoulders applying to the side surfaces of the box, the metallic alloy occupies a rebate in the surface.

The second part of the invention relates to lubrication, which is effected from an oil chamber in the lower part of the pedestal, from which an opening is made to the bearing; in this opening, one end of a lever is placed, which by the greater weight of the other end is held constantly in contact with the shaft; the lever is clothed with a wick like that of a lamp, the capillary action of which carries sufficient oil from the reservoir. The oil chamber and its cover are so contrived as to prevent the oil being thrown out by sudden and violent motion.

The inventor states that an excellent alloy may be prepared by taking about fifty parts of tin, five of antimony, and one of copper; but other alloys may be used.

William Edward Newton, of Chancery-lane, C.E. *for an improved agricultural machine or implement for ploughing, harrowing, or tilling land.* (A Communication.) Patent dated, July 13, 1843; Specification enrolled, January 13, 1844.

The machine which forms the subject of this patent is denominated a harrow plough or plough harrow, from the circumstance of its being applicable to all purposes for which harrows are used, but it may also be employed with advantage in place of different kinds of ploughs now in use.

The machine is composed of two principal but entirely distinct parts, viz. 1st. the fore-carriage, which consists of two wheels, and a framing with the pole or shafts for three horses; 2nd. the hinder carriage, which also comprises two wheels, and the framing of the harrow plough, furnished with seven, nine, or eleven teeth or tines.

The fore-carriage is composed of two wheels placed on one common axletree, to which is connected the pole or shafts. To the centre part of the axletree is bolted a vertical bar of wrought-iron, in the upper part of which a rectangular mortice is made for receiving a pin or bolt, by which the end of a swan's neck framing is held up. Two shafts are connected and bolted to the axletree and cross piece, to which are fastened whippletrees that are intended to receive three horses. The upper end of the vertical bar is sustained and connected by two thin round iron rods to the cross piece, and it also carries another curved rod, intended to support the reins of the horses.

The hinder part of the carriage is composed of a cast-iron swan's neck, which connects the hinder to the fore-carriage. This swan's neck is so arranged as to allow the fore-wheels to pass freely under the same, where it is required to make a short turn round; the head of this swan's neck is traversed by the vertical rod bolted on the middle of the fore-axletree, on which the swan's neck rests. To the other end of the swan's neck is connected a set screw, which passes through a female screw in a plate which is furnished with two pivots, which are free in the bearings, that form the end of the swan's neck, and whereby it is raised or lowered. This screw has at its upper end another small screw, the head of which carries a winch, and when the screw is turned either one way or the other, it raises or lowers the female screw in the plate, and thereby raises the end of the swan's neck. In order to effect this object, it is necessary that the screw should be held in a collar which, without preventing it from turning freely, holds it securely in connexion with a short cross piece, the two ends of which are supported by two bearings in curved pieces bolted on the broadest side of the framing of the hinder carriage. This part of the machine is intended to regulate the inclination of the teeth or tines, and the depth to which they enter, and are intended to cut the earth. The teeth or tines are generally nine in number, these are made very strong, and must be arranged in such manner that each may form a separate furrow. These tines may, however, be exchanged for knives with cutting edges. The two cross pieces are connected to lateral side pieces, and to these side pieces the two wheels of the hinder carriage are adjusted. The wheels are made of cast-iron, and are each mounted on separate axles, and thus simply made to turn freely on short iron pivots fixed at the lower ends of a rack, the greater portion of which is toothed. A pinion, consisting of four teeth, gears into the teeth of these racks, and are firmly fixed on a wrought-iron shaft, which turns in bearings in a cast-iron framing bolted upon the aforesaid lateral side pieces. The pinion may be turned by hand by means of winches or cranks fixed upon shafts or axles, and inside the apparatus; and in order that the hinder framing should be made to remain at any particular

altitude, each of these axles or shafts are furnished with toothed discs which act as ratchet wheels, and are made with as many notches as the pinions have teeth in order to stop at any point, and without allowing the latter any play. Into one of these notches a sort of catch is made to fall, which catch has a handle at its upper end, whereby it may be lifted by hand, and a spring placed behind it in the interior of the box which retains it against a support, and tends always to make it assume such an inclined position as will not allow it to disengage itself from the toothed disc, whatever shocks the machine may happen to experience.

Claims the peculiar combination or arrangement of parts above described, or any modification thereof as applied to the purposes above-mentioned.

William Watson, Junior, of Leeds, Chemist, *for certain improvements in ventilating houses and other buildings.* Patent dated, October 18; Specification enrolled, December 18, 1843.

Instead of "supplying air for the ventilation of buildings from the level on which such buildings are built, as is commonly the case," the present patentee proposes to procure it "from an elevation considerably above them." He lays no claim to "any particular arrangement of machinery or apparatus for drawing or bringing down the air," or for diffusing it through the buildings after it has been whistled down; but asserts his exclusive right to distribute air obtained from such altitudes, "in *any manner or by any means that are now employed*, or THAT MAY HEREAFTER *be devised* for ventilating buildings." The patent, in short, is simply one for securing to Mr. William Watson, Junior, of Leeds, his heirs and assigns, the exclusive use for ventilating purposes of the whole of the air above us, *usque ad astra*, less some 200 or 300 feet, which he graciously leaves *unenclosed* as a sort of (breathing) common for the rest of the world. A veritable *château d'Espagne!* Not the first by a great many, the title deeds of which are to be met with among our patent records; but the first, at least, for loftiness of conception, and modesty of purpose. We may next expect to hear that our self-constituted, "Lord of the Milky Way," has also obtained our Sovereign Lady Queen Victoria's sole license and exclusive authority,—to *put the moon in his pocket.*

CAMPHINE.

Sir,—In your Magazine, No. 1075, you speak of "camphine" as "the popular light." By this I suppose you do not mean English's rectified spirits of turpentine; because you must be aware that Mr. English cannot supply one hundredth part of the lamp spirit which is now consumed. And yet you cannot be ignorant of the fact, that rectified spirits of turpentine, manufactured by any one else, cannot be sold under the name of "camphine." The truth, therefore, is, that *rectified spirits* of turpentine is "the popular light." To that which Mr. English manufactures he appropriates the term "camphine." And he has secured this word for himself, by means of his patent for a certain method of rectification. It is, however, notorious that, after all, the article he produces is neither better nor worse than rectified spirits of turpentine.

Z. Z.

March 21, 1844.

[We thought we had intimated with sufficient distinctness in the article referred to—as it was certainly our intention to do—that camphine and rectified spirits of turpentine were but one and the same thing. Whether Mr. English is the author of the term "camphine" or not, we cannot tell. Certain it is that the word is not once mentioned in the specification of his patent; and that it is not, therefore, by virtue thereof, as our correspondent supposes, that he has any exclusive right to it.—Ed. M. M.]

NOTES AND NOTICES.

The Russian Window.—The sliding window is a characteristic peculiar to the Russian people: even in our own times, compel a Russian merchant or peasant to make double casements for the winter, he will perhaps make them, but he will nevertheless always leave one window free—that can be opened or shut as he pleases with a sliding door. Without this window his house feels to him like a prison—close, stifling, and gloomy: he would, rather than have no free opening, knock out a pane of glass; what cares he, the iron child of the North, for the frost? Surrounded with snow, in the bitterest cold, he opens his beloved little window, and through it admires God's light, the midnight sky, strewn with angel eyes. He looks out at the passengers, going and coming, listens to their gossiping talk, hearkens with a kind of delighted sympathy to the rustling sound of the belated traveller's step upon the snowy road, to the distant tinkle of the sledge-bell, dying faintly along the wintry desert—sounds which have a pensive attraction for the Russian heart.—*The Heretic.*

Steam Traction on Canals.—About the end of the last century—at a moment when other men would have been contented with the results obtained—before Bell or Fulton had shown the availability of the steam paddle-wheel for navigation, the (great) Duke of Bridgewater made an attempt to substitute the steam-tug for horse-towage on his canal. The following notice from one of his surviving servants substantiates this interesting fact—"I well remember the steam-tug experiment on the canal. It was between 1796 and 1799; Captain Shanks, R.N., from Deptford, was at Worsley many weeks, preparing it by the Duke's own orders, and under his own eye. It was set going, and tried with the

coal boats, but it went slowly, and the paddles made sad work with the bottom of the canal, and also threw the water on the bank. The Worsley folks called it *Buonaparte.*" It may be presumed that the failure was complete, for no second trial appears to have been made. Eight coal boats were, however, dragged to Manchester, of 25 tons each, at a little more than a mile an hour.—*Aqueducts and Canals. Quarterly Review for March.*

Economy of Fuel.—In the coldest weather of the present winter (1843), the required degree of temperature and ventilation at the Model Prison at Pentonville was maintained at a cost of less than one halfpenny per cell for 24 hours, although the cost of fuel was at London prices.—*Parliamentary Report.*

Blasting by Electricity.—A very interesting display of engineering skill took place at Knockmaroon-hill, in the Phœnix-park, Dublin. A huge mound of earth covering a quarry had been perforated with nine chambers, in which two tons' weight of gunpowder had been so distributed as, by the application of the galvanic battery, to be exploded at once. The operation was conducted under the superintendence of Captain Larcom, of the Royal Engineers, and at a little after three o'clock, everything being in preparation, and all due precaution being taken to prevent accidents, the explosion took place without any very alarming noise, the vast mound of earth rising, wave like, about three or four feet, and then rolling over in a dense mass into the hollow underneath. The object of the experiment, which was completely successful, was for the purpose of cutting away a high precipice, so as to form an inclined level with the road, or pathway, below it. About twenty feet of the park wall close to the embankment, gave way from the effects of the concussion, but no other casualty occurred.

Caution to the Users of Naphtha Lights.—On Sunday evening last, an accident, attended with very serious consequences, occurred at Longsight, from the use of naphtha. Mr. Wm. Holt, shopkeeper, of that village, was preparing to light the lamps of the Independent chapel there, which lamps are fed by naphtha, and for that purpose went into his kitchen about a quarter before six o'clock, and was pouring some naphtha from a corked tin can, holding about a gallon of this inflammable liquid, into a phial, to take with him to the chapel, and his sister was holding a lighted candle, when by some means the naphtha ignited and exploded with a loud report; and the kitchen appeared to the brother and sister to be in flames. Miss Holt's dress caught fire, and in the agony of the moment she rushed into the lane and called out for assistance. She was very extensively and seriously burned. From the force of the explosion, it is not improbable that a portion of it had been vapourised by the warmth of the kitchen, and thus produced a highly inflammable gas, which had been inflamed by coming in contact with the flame of the candle. The exceedingly inflammable character of the naphtha renders it a dangerous substitute for oil; and there cannot be too great caution exercised by those using it.—*Manchester Guardian.*

The "Great Western" and "Great Britain" Steam Ships.—Although we believe it to be a judicious step, in the present state of the affairs of the Great Western Steam Ship Company, to sell the celebrated vessel from which they take their name, it is not without regret we have to state that this first of ocean steamers has passed into other hands, having been sold to the Oriental Steam Navigation Company for 32,000*l.*, including her late complete repairs. As she will be employed as a packet-ship, she underwent a thorough inspection on the part of the Government. Her timbers were opened in various places, and, with one trivial exception, they were found to be in sound and admirable condition. This strict scrutiny concluded, there can be no doubt as to the reputed excellence of the *Great Western* as a sea-boat, notwithstanding the tear and wear and buffeting she has undergone since she first sailed from Bristol to New York. As to her colossal successor, the *Great Britain*, we hope the solicited mediation of the Board of Trade will be available for her liberation. On further consideration of the plan of floating that huge vessel of 3,600 tons, out of the too narrow dock, on iron tanks, it appears to be so fraught with danger, that we understand it must be abandoned. So then the *Great Britain* is in the predicament of the fattened weasel, that, while feeding and fattening in the farmer's granary, grew too big for the hole by which it gained admission. The mutual difficulties of the Steam Ship Company and the British Dock directors have, however, been fairly brought under the consideration of the Board of Trade. The case is one in which the nation at large is concerned, and the interests of commerce and navigation are not a little involved; and though it is anomalous and without precedent, it cannot surely be without remedy. The great prisoner at the bar cannot be incarcerated for ever, but will doubtless soon be transported beyond seas.—*Bristol Mirror.*

Ancient Fire-extinguishing Machinery. — On Tuesday (March 26) much curiosity was created in the vicinity of the chief station of the Brigade force in Watling-street, in consequence of one of the old fire hand-pumps, or squirts, being tested by the firemen, so as to ascertain how far it could be made applicable in the present day. The result was quite satisfactory, and there is every probability of their being again called into requisition, and that every Brigade station will be supplied with them. The one in question is one of the four that were saved from the great fire of London.* They have for many years been the property of the parish of St. Dionis Backchurch, Fenchurch-street, the churchwarden of which, hearing that it was the desire of the Superintendent of the Brigade force to test their capabilities, permitted one of them to be tried. It is in the form of a large syringe, composed of brass, two feet in length, with about half an inch rose-pipe, and containing about half-a-gallon of water. These singular machines, a few centuries ago, were the only means of suppressing fires. It requires two persons to work them, handles being on both sides; and on their being charged they are raised, and by the united strength, the piston-rod is forced forward, and a jet of water is thrown to a considerable elevation. On the present occasion the firemen tried this "miniature" fire-engine against St. Mary Aldermary church, and with much ease threw a jet on to the roof, a distance of upwards of 60 feet (?) Owing to the complete success of the experiment, it is the intention to have several forthwith constructed, as it is considered that they would be very effectual in subduing small fires, and thereby prevent so great a spoilage from water, as *now unavoidably* takes place.—*Times.*—[Is the Superintendent of the Brigade force aware of the numerous improvements made in the syringe (by Scott, Read, and others) during the last two centuries? Or has he yet to become acquainted with the very excellent and effectual modern contrivance for preventing the great spoilage from water which now so frequently takes place?]

* A drawing and description of these machines, by Mr. Baddeley, appeared in vol. xxx. p. 116.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1079.] SATURDAY, APRIL 13, 1844. [Price 3*d*.

Edited by J. C. Robertson, No. 166, Fleet-street.

ROLLS' CONTINUOUS LIFTING AND FORCING PUMP.

Fig. 1.

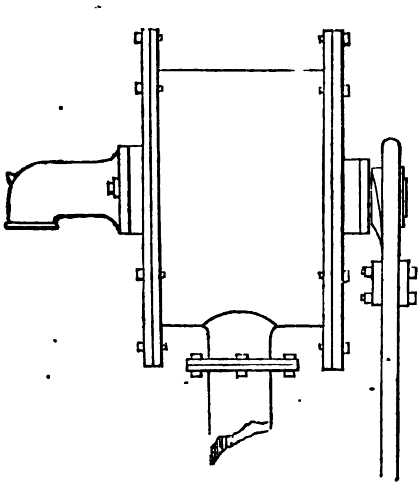


Fig. 2.

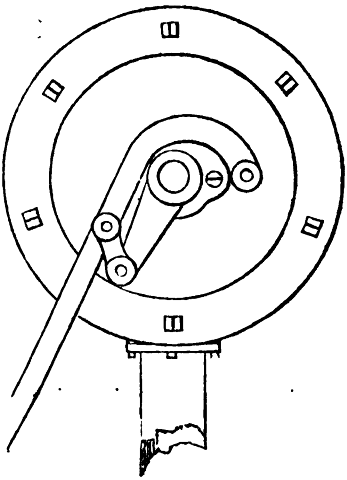


Fig. 3.

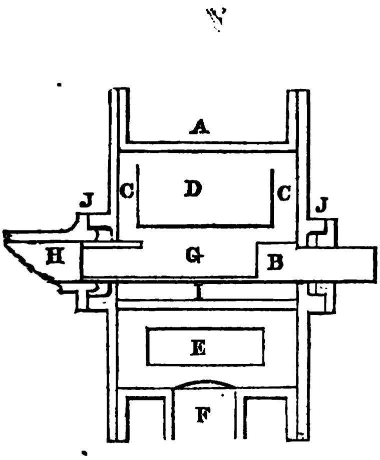
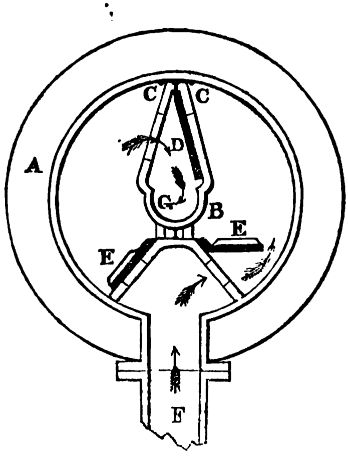


Fig. 4.



ROLLS' CONTINUOUS LIFTING AND FORCING PUMP.

Sir,—The accompanying drawings represent a pump I invented about 18 months since. I had an idea of taking out a patent for it, and applied at your office on the subject; but finding it would be attended with a considerable expense, and not being in a line of business to carry out the thing to advantage, I have given up the intention of so doing. I therefore send it to you for publication, if worthy of it. I think that pumps on this plan might be constructed (if the experiments I have made be correct) so that one man might throw from 90 to 100 gallons of water per minute. They might be made in a variety of ways, according to the power and quantity of water required; but one on the plan represented in the accompanying sketches would, I consider, answer best for all common purposes.

Fig. 1 is a side, and fig. 2 a back view, of the pump when complete. Figs. 3 and 4 are sectional views of the same.

A is a cylinder with a flange at each end, with plates or lids to fit, with stuffing-boxes, J J, in the centre. B is a hollow shaft, working through stuffing-boxes, J J. C C is the piston or arm, which is hollow, and fixed on the shaft B. D is a double valve in the piston, as better seen in fig. 4. E E are the lower valves over the suction pipe F. G is the delivery passage through the hollow shaft B, and the nozzle H, which forms part of the stuffing-box on that side.

When the piston is moved by the raising of the handle from the left to the right side of the cylinder, you fill the left chamber with water, and by the down stroke the piston returns from right to left of the cylinder, and so forces the water in the left chamber of the cylinder through the valve D, and out through G and H (not being able to pass back through E), while, at the same time, the water is drawn from the suction pipe F, up through valve E into the right chamber, as shown by the arrows in fig. 4. In this way you get a continued stream of water, that is to say, you get as great a lift of water by the up stroke of the handle, as you do with the down.

I am, Sir,

Your obedient servant,

Thos. Rolls.

3, Frederick-place, Upper Kennington-lane,
December 27, 1843.

THE LATE BOILER EXPLOSION AT BRADFORD.

Sir,—In No. 1076 of your very excellent periodical, I observe an account of the fatal boiler explosion at Bradford, and the following week a communication on the same subject signed "J. C.," in both of which an attempt is made to assign a sufficient cause for this dreadful catastrophe, though, from the imperfect evidence given at the inquest, it is almost impossible to arrive at any just conclusion. With your permission, I will offer a few remarks on the circumstances attending this explosion, which may not be uninteresting to parties using steam boilers. From the evidence there appears to have been only one safety-valve used on the boiler, although two have long been considered by eminent engineers absolutely necessary. This valve, however, was probably in good order, from the fact of its being tied up every night to allow of the escape of the steam, and consequently could not well fasten in so short a time. It would be irrational to suppose the explosion could be caused by a pressure at which the boiler had worked for some months preceding the accident; there must have been some sudden formation of steam, which, added to that already contained in the boiler, proved too powerful for the strength of the vessel to resist. It is still a favourite supposition that hydrogen gas may cause an explosion in steam boilers, though many eminent men have shown this to be *impossible*, from the impure state of the hydrogen, and the absence of air. Allowing, in the present case, this boiler to have contained atmospheric air, from whence do we derive the hydrogen? To form it in any quantity, there must be decomposition of the steam, and abstraction of the oxygen, and to produce this effect the boiler must have been at a very high temperature;

and if we allow such to have been the case, there must necessarily have been a deficiency of water. Besides, all boilers, on blowing off the steam, are filled with air, purposely to prevent the danger of a vacuum inside. This is an hourly occurrence, yet explosions are comparatively rare. It is stated in the evidence, that there was no valve between the force pump and the boiler, such valve being unnecessary. This may be the case; but where parties have any regard for their property, and the lives of their people, they would assuredly use this valve; otherwise, should any accident occur to the force pump delivery valve, the pump might be merely drawing water from the boiler, and forcing it back again, while the engine tenter was not aware of it. There seems to have been some doubt respecting the action of the float, which apparatus, I may observe, must not be implicitly relied on, being so near an equilibrium, that a small amount of friction in the stuffing-box, through which the float-rod passes into the boiler, will prevent its action. Taking the whole amount of evidence, it appears probable that there was a deficiency of water in the boiler, either from leakage, or some cause not shown at the inquest, of which the engine tenter was not aware. Your correspondent "J. C.," in No. 1077, offers a very ingenious opinion as to the cause of this accident, though it may be doubted whether the mere heating of water slowly would prevent it from throwing off its vapour. There can be no intermediate state between water and steam; once converted into steam, and it rises by the law of gravitation. By putting the water in motion, you merely assist the process.

I have to regret the invariable want of a scientific inquiry in all cases of boiler explosions; this important office being too frequently left to parties unacquainted w[illegible] the subject. It would be well were t[illegible] Government to appoint a competent p[illegible]son in each county, to be called in on s[illegible] occasions to conduct the examination, a[illegible] furnish evidence, from which might b[illegible] made something like correct deduct[illegible]s.

Your most obedient servant,

THOS. LIDDELL.

[illegible]wcastle-on-Tyne,
April, 1844.

MR. WOOLLGAR ON FRIENDLY SOCIETIES.

Our valued correspondent, Mr. Woollgar, whose labours in connexion with the sliding rule must be well known to all the readers of our work, has recently devised an application of that instrument which promises to be most extensively useful. As he has given his improvement to the world through another channel than our pages, it devolves upon us to lay some account of it before our readers.

It will be seen from the title of Mr. Woollgar's work, which is given below,* that it relates to the subject of Friendly Societies. There can, we think, be no doubt that such societies, if properly organized and conducted, are calculated to produce the most beneficial results. They engender in their members habits of economy and forethought, and provide them with comforts, in periods of disease and decay, which are attainable in no other way. But, on the other hand, we think it is extremely questionable whether, on the whole, they have not hitherto been productive of at least as much harm as good. Too often have their funds been found wholly inadequate to meet the demands made upon them, in consequence of which their members, instead of deriving from them the benefits they were justly entitled to expect, have been doomed to the evils of penury, and thus subjected to the very calamity which they had spent the energies of their best years in seeking to avert.

The inadequacy of the funds may arise from various causes, such as improper application of them, miscalculation in the outset; or, what previous calculation can hardly guard against, an unfavourable departure from the course of events experienced in other and similar cases. But to whatever cause this inadequacy may, in any particular instance, be traced, the remedy is in all cases the same. It is, either to reduce the amount of benefit promised, or to increase the future payments in respect of each bene-

* Friendly Societies' Security.—An Essay on testing the condition of a Friendly Society, by Valuation of all Policies at Annual or other short Periods, without resorting to a Professional Actuary. Also, Observations on the Rates of Contribution, and an entirely New Series of Elementary Calculations applicable thereto; with other practical points connected with such Societies. By J. W Woollgar, F.R.A.S. Lewes: R. W. Lower. Lo don: Whittaker and Co.

fit. This remedy, it is evident, will press pretty equally on all the existing members of a society; and it is also evident, that the earlier it is adopted, after the evil has begun, the lighter will be its pressure. But from the nature of the case the evil may have been going on long before its existence is even suspected; and it may only be discovered when it is too late to prevent its direful results. To guard against this danger—to detect the evil as soon as it *can be made* to show itself—the necessity of frequent periodical investigations of the affairs of these societies, has been strongly insisted on by all writers on the subject. And had this recommendation been more generally acted on, there is no reason to doubt that many societies, which by their failure have been the means of occasioning a vast amount of distress, would have been at the present time in active operation, and dispensing their benefits to all concerned.

The test of solvency in a society is, when the accumulations of previous years, together with the value, *at the time of valuation*, of all the future premiums, is not less than the value, *at the same period*, of all the liabilities. In other words, a society is solvent when it is possessed of funds sufficient to buy up the policies of all its members, but not otherwise. Now the valuation of the policies, as this operation has been hitherto conducted, is a work of considerable labour; and, as it also requires some skill, a professional person has usually to be employed, and this is necessarily attended with expense. Hence the precaution recommended has been too often altogether neglected, and from this neglect have arisen the disastrous results already described.

Mr. Woollgar, in the work before us, strongly urges the propriety of these periodical investigations. But he does more: he describes a method by which the necessary valuations may be effected with the greatest facility, and thus removes the obstacle which has hitherto stood in the way of this most wise precautionary measure.

The value of a policy is, in all cases, the excess of the value, *at the time of valuation*, of the benefit to be received, over that, *at the same period*, of the premiums remaining to be paid. But when, as is always the case in Friendly Societies, the benefit is paid for by a uniform periodical premium, there is another way in which the value of a policy may be ascertained. To take a case along with us: Suppose a person now aged 35 effected 5 years ago an assurance of 8*s*. a week, during sickness, till 65, for which he was to pay by an uniform monthly premium to continue till 60. Now we find, by the table of elementary values appended to Mr. Woollgar's work, that the premium that would have been required of him for this benefit is 12·904 pence. This premium, therefore, he has paid since the assurance was effected, and will continue to pay till he reach the age of 60. Moreover, we find, by reference to the same table, that if he were now to effect an assurance for the same amount of benefit, the premium that would be required of him would be 14·837 pence. Hence, he has that for a monthly payment of 12·094 pence, the actual value of which is a similar payment of 14·837 pence. The value of his policy, therefore, is the present value of a monthly premium of (14·837—12·904=) 1·933 pence, or of an annuity to cease at 60 of 1·933 shillings, payable monthly, in advance. Now the value of an annuity of one shilling payable in this way, and for the same period, is, by the same table, 14·168 shillings. Consequently, (14·168 × 1·933 =) 27·387 shillings, or 1*l*. 7*s*. 4½*d*., is the value of the policy.

This is the principle, with a slight variation in detail, adopted by Mr. Woollgar. He takes the premiums on the supposition that the amount of benefit is one shilling per week, and multiplies their difference by the annuity, and by the actual amount of benefit, and thus reduces the operation to a subtraction and a multiplication of three factors. But this is not all. He explains, p. 10, a contrivance by which the difference between the premiums (which difference he calls the "Factor for value") may be obtained with great facility; and he describes and figures a most ingenious modification of his favourite instrument, the sliding rule, by means of which the multiplication of the three factors may be performed by a single setting of the slide. The rule is 12 inches in length. The slide contains a single radius of the usual logarithmic scale. The stock contains two scales, the one over the other. On the lower scale is marked "age attained," and on the

upper, "benefit per week." By a further contrivance, he not only adapts the face of the rule to two periods of termination of premium, but also, by repeating on the lower part of the slide the scale on its upper part, beginning at different points, he makes the single radius on it serve the purpose of two radii, so that, as already said, a single setting is always sufficient.

The formula by which the value of a policy is shown in his rule then, is,—

$$\frac{\textit{age attained.} \qquad \textit{weekly benefit.}}{\textit{factor for value.} \qquad \textit{value of policy.}}$$

That is, set the factor for value on the slide to the age attained on the stock; then, against the weekly benefit on the stock, will be found on the slide the value of the policy.

To illustrate this we may verify by the compasses, on Mr. W.'s drawing, the valuation we have made above. The premiums on Mr. W.'s supposition of one shilling weekly benefit are 1·613 and 1·855. The factor for value therefore is,

$$1·855 - 1·613 = ·242.$$

Hence, if, on that part of the stock which corresponds to premiums terminating at 60, we extend the compasses from the age attained, 35, to the weekly benefit, 8s., we shall find that the same extent will reach on the slide from ·24, the factor for value, to 27·4,* the required value of the policy.

Mr. W. states that he finds two minutes amply sufficient for the determination and writing down of the value of a policy by the method he proposes. The time appears to us to be certainly not understated, and it shows the immense advantage possessed by his method over that previously in use.

Appended to Mr. Woollgar's work is an ample "Table of Elementary Values," which he proposes for the adoption of Friendly Societies, to which the drawing he has given of the rule is adapted. But we observe (p. 12) that rules may be had [illegible]order,† adapted to any of the rates of [illegible]rtality in most general repute; so [illegible]t no society need be deprived of this [illegible]uable aid.

The Table of Elementary Values possesses a most commendable feature, and one well worthy of imitation. Every number it contains is accompanied by its logarithm—an arrangement by which the labour of calculation will be greatly facilitated. The results of this table are generally safer than those given by Mr. Ansell.

The method of valuing policies, to which, in our remarks, we have chiefly confined ourselves, forms but a portion of a system proposed by Mr. W. for the more effectual protection of Friendly Societies from the casualties which have heretofore in so many cases operated so injuriously. This system we think calculated to answer the end in view most effectually. But on its details, as well as the author's suggestions as to the mode of conducting Friendly Societies, and his remarks on the various rates of mortality and sickness which have been proposed for their guidance, our space forbids us to enter. This we the less regret, as we believe we have already said enough to induce such of our readers as take an interest in the subject, to consult the work for themselves. It has our cordial recommendation.

* Greater particularity cannot be attempted on [illegible] *paper* representation before us, which is, be[illegible]es, on a smaller scale than the rule itself.

† Of Mr. Booker, 26, East-street, Lamb's Con[illegible]t-street, price about seven shillings each.

MR. BAGGS' VICTORIA LIGHT.

Mr. Baggs, of whose new light we gave a description in our No. 1035, delivered a lecture upon it last week at the Literary and Philosophical Institution, Cheltenham. We extract from the Report of it given in the *Cheltenham Free Press* of the 6th inst., some passages worth reading, as well on account of the remarks they contain on the general subject of lighting, as of the farther information which they afford respecting the nature of Mr. Baggs' light in particular.

"Flame is nothing more than the chemical combination of gases or vapours having an affinity one for another. This combination is invariably attended in a greater or less degree with the developement of heat, but light is not always its necessary concomitant. To produce this latter it is absolutely essential that the flame should be well supplied with a quantity of solid matter, in a very finely divided state. Thus, though the combustion of common hydrogen gas gives rise to a great increase of temperature, it produces scarcely any light, for the flame is purely gaseous, and destitute of any solid material. So, in ordinary coal gas which consists of this same element—hydrogen,

united with a variable proportion of carbon, it is the carbon alone which produces the light, the combustion of the hydrogen serving, however, to bring its solid particles to the requisite degree of incandescence. So completely, indeed, does the luminosity of coal gas depend upon the presence of carbon, that the relative value of different specimens of gas may be accurately determined by merely weighing them, and then calculating from their specific gravities the quantity of solid matter which each contains.

"This is in fact the method most generally adopted by the practical engineer and analytical chemist. The gas is not burnt, to ascertain its precise brilliancy and commercial value, it is weighed.

"A single example may suffice, not only to illustrate the accuracy of this method of comparison, but to show in a marked manner the very different kinds of gas produced from different species of coal, and the impoverished state of all with regard to the true element of light—carbon. One hundred cubic inches of London gas weigh about 13 grains; and one hundred cubic inches manufactured by the New Liverpool Gas Company weigh nearly 18.

"The relative value of light, which a given measure of each is capable of affording, is as 2 to 4½ nearly, and yet even the best of the two samples is very very far from containing the proper amount of solid matter which it ought to contain, and which it is capable of consuming. The gas at Nottingham, Derby, and other places is even worse than that manufactured at London.

"The price per thousand cubic feet is nowhere regulated by a reference to the comparative quantity of light which the gas is capable of affording; but very frequently in direct opposition to this, the only just and rational basis for calculation. For example —London gas is sold for eight and nine shillings a thousand feet; and that at Liverpool, which, as we have just seen, is much superior in illuminating property, may be had for 7*s*. Carbon is everywhere deficient to a most ruinous extent, and the benefits of gas illumination, great as they undoubtedly are, have not yet been worked out to a tithe of the extent of which they are capable.

"We can readily understand that a certain small proportion of the non-luminous element hydrogen, is necessary in every case, both to enable the carbon to preserve the aëriform state, and to contribute by its own combustion to increase the heat of the flame; but this proportion is always very far exceeded, to the prejudice of the consumer, and hence, in every instance throughout the kingdom, where gas light is used as the medium of illumination, a large proportion of the charge made is absolutely levied upon a fictitious commodity! It is most true that this evil is unavoidable under the present system; but then it ought to be remedied.

"Turning now to another part of the subject. The imperative necessity of a good supply of atmospheric air, in all cases of ordinary combustion, is so well known and so generally understood, that it may be almost deemed supererogatory to allude to it here. Nevertheless there are certain points which demand at least a cursory notice—for though known to many, they may not be familiar to all; and the share they take in modifying the phenomena of flame is certainly neither slight nor unimportant.

"Several different *qualities* of light may be produced from the same gas, merely by regulating the amount of atmospheric air which is allowed to reach the flame in a given time. If the construction of the burner is such as to throw obstacles in the way of a firm and rapid ventilation, the light will be of a very inferior quality.

"The combustion may be full and complete, but the flame will nevertheless be wanting in that brilliancy of tint, and intensity of colour, which are so much sought after, and so justly admired.

"If, on the other hand, we facilitate the process of ventilation, and ensure a good current of air, by the introduction of appropriate mechanical contrivances, the phenomena will be completely altered. Combustion now proceeds with much greater rapidity, and the quantity of light is considerably decreased, while its quality is augmented in an equal ratio. Hence it appears that in producing light by the combustion of coal gas *alone*—*one* of two evils must be incurred, either the flame must be of inferior quality, or the consumption of gas must be increased, for by no other means can we compensate for any decrease in the absolute quantity of light. When, however, coal-gas is employed, not as a sole and independent agent for the production of light, but as a medium for exciting luminosity in other bodies, by the intense heat which its combustion affords, then the light may be brought to any desirable pitch of purity and brilliancy without incurring the slightest loss or disadvantage— for, as in this case, the flame may be saturated with carbon from other sources, the destruction of quantitative illumination in that small portion which the gas itself contained, becomes of no moment whatever.

"Sufficient stress has not hitherto been laid on the great importance of a pure light to the preservation of the organs of vision. Economy has been everywhere the ruling consideration, (a very proper consideration, by-the-bye,) and yet all are aware of the

extent of injury done to the eyes by the continued action of a bad light, that of an ordinary fire, for instance: and let it be remembered that candles, oil lamps, and even gas itself, are only so many steps in advance of this primitive method of illumination—great ones, it is true, but very far removed from perfection notwithstanding.

"A moment's consideration will convince any one, that the relative characters of different flames are solely dependent upon the concentration of heat in each instance. To take two extreme cases. What is it that produces light in the burning of the dull flaring torch? particles of carbon in a state of ignition. And what is it that produces that beautiful and almost overpowering light when the voltaic discharge is passed through charcoal points? Particles of carbon in a state of ignition, also. Nothing more! And yet a *comparison* of the two flames is almost ridiculous. Here is the same ignited material in the one case as in the other. What then causes the extraordinary difference between them? Their relations to caloric alone. In the red light of a torch the diffused particles of solid matter are but feebly heated, as we can easily demonstrate by many simple experiments; but in the pure and almost heavenly light emitted by galvanism, the heat is so intense that nothing can withstand it. Platina melts in it like wax in the flame of a candle, and the most refractory minerals, when submitted to its influence enter into immediate fusion. Difference of heat, then, is the main-spring and primary source of variation in similarly constituted flames.

"In advocating, as I do, the adoption of the most brilliant light which art is capable of producing, in any way consistent with economy, I shall perhaps lay myself open to the objections of those who argue that such lights are too bright and powerful for ordinary purposes, and that they are calculated to do injury to the visual organs. Nothing can be more opposed to fact than this is. Let us refer to nature. The centre of light—the great luminary of day, whose dazzling effulgence is built up of an inconceivable excess of those physical attributes, is as harmless, nay, as necessary to the existence man as the very air which he breathes. powerful rays are so softened by atmoerical refraction, and so blended and tered by masses of cloud and vapour, that suffer nothing by their intensity. Indeed, would save us much trouble in this, as in ny other matters, if we studied the book nature a little more attentively. Her nderful adaptations and contrivances, in rking out the grand scheme of the universe, based upon such subtle and sublime phiophy, that if we aim at simplicity and perfection we cannot do better than endeavour to imitate them. On the whole, then, I think we may safely conclude that the nearest approach to perfection in artificial illumination will be made by the adoption of a light of the greatest intensity—whose rays are so broken and scattered by refraction and reflection, that, uniting gentleness with power, they satisfy without tiring the vision and reach the eye in the most pleasing, grateful, and innoxious form."

Mr. Baggs proceeded to observe, that the audience had doubtless come with high expectations, and that if they entered into the question of economy, their expectations would be realized; but if they expected to see a light like galvanism, or the oxy-hydrogen light, they would be disappointed. All he proposed to show them was a sufficient light *for purposes of utility at a considerable reduction in the cost of producing it.*

Mr. Baggs then exhibited the light, which far surpassed that of a single argand burner burning 6 feet of gas in an hour, while the new light only consumed 1 foot of gas in the same period. The vapour of naphtha which caused such an economy in the consumption of the gas was very little expense. The light caused a considerable rushing noise, but this was shown to be very easily obviated by placing a wire gauze in such a position that the gas should pass through it before it ignited.

A larger lamp was next exhibited, which burnt 2 feet of gas in an hour; this was almost sufficient to light the large room of the Institution, which is generally illuminated by eight argand gas burners. The price of the gas for such a lamp for twelve hours would be twopence, the other materials about a halfpenny.

DEATH OF STIGLMAYER, DIRECTOR OF THE ROYAL FOUNDRY, MUNICH.

[From a letter in the *Allgemeine Zeitung*, dated Munich, 4th of March.]

"With a heavy heart I now take the pen, in order to acquaint you of the loss which has befallen us. Johannes Stiglmayer is dead. For the last two years, suffering from an incurable stomach complaint, he saw his strength decrease, but still endeavoured—if not in himself, at least in his family—to keep alive, with a cheerful spirit, the hope of recovery. Since the middle of January, from which time he had been almost constantly confined to his couch, he occupied himself principally with the casting of the colossal statue of Goethe, which was ordered to ornament the native city of the poet; for although Stiglmayer had brought up his sister's son, Ferdinand Miller, to be a valuable

assistant and representative, still he knew too well, from his many years' experience, the importance and the danger of so great an undertaking, to be quite free from all anxiety respecting the result. The work, in the meantime, was no longer to be delayed, and, after all preparations had been made, the casting commenced on Saturday, the 2nd of March. With alternate feelings of confidence and fear, the disabled artist lay upon his sick bed, waiting for intelligence, which was brought to him every five minutes, respecting the progress of the work; till, at length, on the completion of the casting, his nephew entered the room and took the burden from his heart, by announcing the perfect success of the undertaking, and was embraced by him with a twofold fervency of joy and affection. The friends of Stiglmayer, whom interest in the casting of the statue had led to the foundry, entered singly into his chamber to congratulate him; and he, supporting his head on the breast of his beloved nephew, spoke to each a friendly grateful word, and received from each, with gentle consolation, the best wishes for a speedy recovery. But these were the last words which he spoke on earth—this was the last joy which he experienced among us: he laid himself down, as if wearied; the breath, which had before been drawn with difficulty, was light and easy, but about half-past nine in the evening was stilled for ever. Thus he parted from us, attended by all that the pious confidence of his heart, the joy of his profession, the love of his family, the faithful attachment of his friends could give, and the memory of the just follows him.

"Stiglmayer, on the 18th of last October, was fifty-two years of age; he was the son of a shoeing-smith of Fürstenfeldbruck, in the neighbourhood of Munich. He was originally a die-engraver, but in the year 1820, during a residence in Italy, especially in Naples, where he was present at the casting of Canova's equestrian statue of Charles III., he had his attention turned to bronze-founding, to which he has been devoted ever since. The success of great and difficult undertakings, the casting of bronze obelisks, the monument of King Maximilian, of the equestrian statue of the Elector Maximilian, of Jean Paul at Bayreuth, of Mozart at Salzburg, have created for him, and the royal institution under his guidance, a widely spread and universally acknowledged celebrity, so that besides the commissions of the king of Bavaria, he received orders from all parts of Germany, Carlsruhe, Darmstadt, Frankfort, Vienna, Prague—nay, from Naples, and even from South America itself. Earnest and severe in the fulfilment of his duties, mild and kind in word and conduct towards every one alike capable of enjoyment as well as of giving joy, acting together in thought and feeling, artist and man at once from the same mould, he called forth involuntarily in all who approached him, an irresistible emulation of love and esteem. No one could know him without becoming attached to him; and as his life has given to his name an imperishable glory in the history of German art, so has his too early death given an imperishable pain to his friends. His remains were interred at Neuhausen, and the great concourse of people of all ranks who attended, testified the high estimation in which he was held, both as an artist and as a man.

"This great artist had carried the art of casting metals to the highest point it had ever reached in Germany. The monuments of colossal grandeur for which the Germans are indebted to him amount in number to 193, amongst which figure in the first rank the equestrian statues of Maximilian I. of Bavaria, and the Electors, his predecessors; the obelisk erected at Munich, in commemoration of 30,000 Bavarians killed in Russia; the statues of Schiller, Richter, Mozart, Beethoven, Bolivar (Bolivia), and last, the statue of Goethe, who was the intimate friend of Stiglmayer, at the execution of which the latter, although ill, worked with so much ardour, that two hours after the cast was terminated, and even before the mould was broken, he expired in the arms of his assistants. Some months previously M. Stiglmayer, although he then enjoyed excellent health, had a solemn presentiment of his approaching death. From that moment he occupied himself night and day in preparing instructions for the execution in bronze of the statue of Bavaria, of which the celebrated sculptor, Schwanthaler, is now completing the model, a monument which is to be 68 feet high, and which, after the famous Colossus of Rhodes, will be the largest piece of sculpture which ever existed. Fortunately, the instructions given by M. Stiglmayer have been committed to writing. They are most complete, and will be of the utmost utility to the artist to whom shall be intrusted the gigantic operation of casting in bronze this immense monument."

MR. BIRAM'S STERN PROPELLER.

Sir,—I enclose a drawing of my stern propeller, which differs in some respects from that given in the *Mech. Mag.* vol. xxxvii. p. 321, with the specification of my patent, and referred to in the description given, although the same principle of construction, is still adhered to. I have divided the wheel into two parts, which I am of opinion will be an improvement: *a*, *a*, are what may be called the sculls,

or propellers; and b, b, the arms. The action of propellers upon the water must necessarily exceed the speed of the vessel propelled, the periphery of a paddle wheel often rotating one-third quicker than the speed of the vessel. As in wheels of this construction, the parts approaching the centre can have very little

Fig. 1.

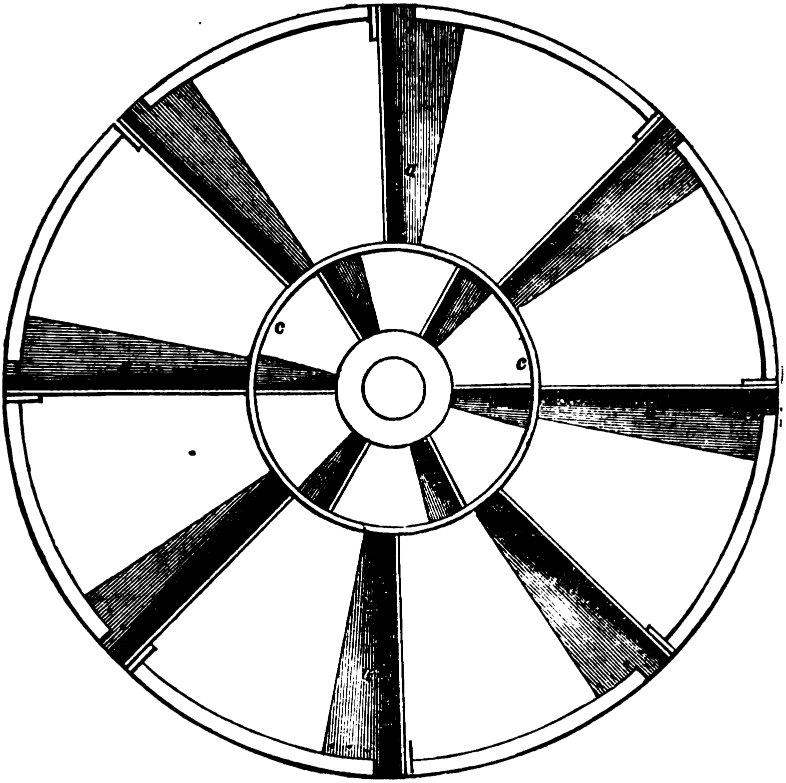
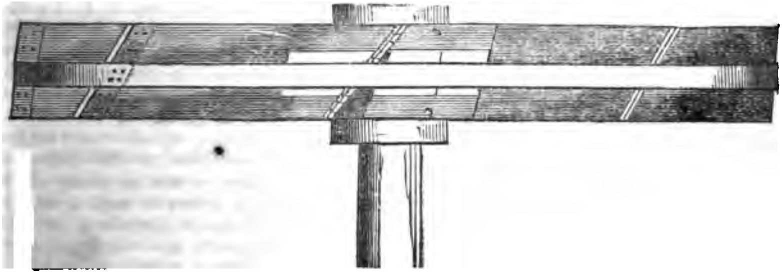


Fig. 2.

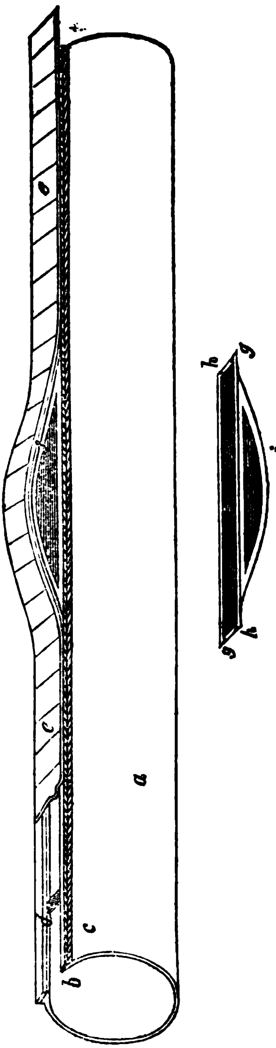


ef :t in propelling, but have rather a re .rding action, I have considered w ıt should be the form of the arms, so as › offer the least resistance to the boat, aı have therefore so formed them in the drawing, that supposing a slip of one-third in the propellers, the arms would pass through the water with the least possible resistance; that is, the angle which the sculls make with the plane c

in the interior of the tube, must be attended by a corresponding amount of leakage. The passage from one section of the pipe to another presents some formidable mechanical difficulties, which, however, ingenuity and perseverance may soon overcome; and the method of stopping the train by brakes, when travelling at a high velocity seems objectionable, while admitting the air in front of the piston would cause a considerable loss of power. Still the system presents many advantages besides the facility of overcoming steep ascents, and economy in working, already mentioned, among which the absence of the usual locomotive engines, is perhaps the most remarkable. Instances of the frightful effects of fire and high pressure steam on railways are fresh in the memory of the public, and any system of elemental locomotion which can be advantageously worked without the unpleasant vicinity of these dangerous agents, must be hailed as a public benefit of no small importance.

It appears to be now a well-established fact that power can be transmitted to a great distance by applying the prime mover to exhaust the air from a tube at one end, while the atmospheric pressure acts on a piston at the opposite extremity; and the question presents itself—*could not the power thus transmitted be made available on common railways, by causing the pressure of the air to act, in the manner of steam, on reciprocating or rotary pistons moving in the well-polished cylinders of pneumatic locomotive engines, communicating by means of a sliding valve with the interior of a tube of moderate diameter laid along the line, and exhausted by stationary engines set at proper distances?* I answer unhesitatingly in the affirmative; and this mode of applying pneumatic power does not present any startling difficulties, as will be seen from the following brief explanation.

Let *a* represent the pneumatic tube (about twelve inches diameter) laid between the rails, and extending the entire length of the line, the longitudinal aperture *b* being three or four inches wide, and bounded on each side by the flat ledge or flange *c c*. This aperture, or chase, need not be uninterrupted as in the common atmospheric tube, but may have narrow bars across formed in the casting at short intervals, as shown at *d*, which will strengthen the tube and prevent collapsion, however thin the metal. On the face of the ledges *c c* is firmly cemented a covering of air-tight leather, or similar substance, presenting a plane, smooth surface on which rests a flat longitudinal valve *e*, formed of air-tight leather, or other elastic, impermeable material, strengthened on the upper side by a continuous series of hinge-flaps or like contrivance, which will not impair the perfect flexibility of the valve. When the air is partially removed from the interior of the pipe, the weight of the external atmosphere will press down the valve on its seat,



and prevent leakage when the fitting i accurate. Fig. 2 is an inverted view of a sliding valve, or box, made of highly polished metal, and *f*, fig. 1, shows the same in its proper position on the tube, inserted between the surface *c c* and the long valve. Its extremities *g g* are tapered off to an

edge blunted only sufficiently to obviate the risk of cutting the surfaces between which it moves. An oil vessel fixed to the outside of this slide furnishes, through minute apertures *h h* near the extreme edges, a supply of oil which lubricates the surfaces, and prevents leakage by filling the minute interstices which might remain open at the extremities of the slide between the long valve and its seat. To the lateral openings *i i* of this slide are attached flexible tubes communicating with the eduction passages of the pneumatic locomotive engine, which should be a little in advance of the slide, and so connected with it as to cause a simultaneous motion of the slide without any tendency to raise it from its seat. The lateral guides, connecting rods, oil vessels, and other minor details, are not shown.

If we imagine a common locomotive engine without its boiler placed on a railway, to which is fitted a pipe furnished with a valve and slide of the above description, the eduction passage or waste steam-pipe of the cylinders being connected by flexible tubes with the lateral apertures of the slide, while the steam-pipe is open to the atmosphere, it will appear evident that a partial exhaustion of the pipe will occasion a diminution of pressure on one side of the pistons, while the entire weight of the atmosphere acting on the opposite side will produce a motive force proportionate to the degree of rarefaction in the tube, and the engine will be propelled forward, drawing with it the slide, as long as the stationary engine or engines continue to withdraw the air from the pipe.*

A slide thirty inches long by six inches wide, presenting an aperture of about 100 square inches area, should be sufficient for the largest engine, and the smaller it can be made with good practical effect, of course the better. As the entire pressure of the atmosphere on a given surface would be only about one-third of the steam pressure used in common locomotives, and as in practice we cannot expect to obtain by the atmospheric system more than one-fourth f such pressure, the pneumatic engines, to roduce an equal effect, must be propor-.onately larger. It has been shown above, hat to obtain an effect equal to the power (pended in producing the vacuum, the at-ıospheric pressure must be applied expansively, which involves the necessity of still more capacious cylinders if single, or more complicated apparatus if double cylinder engines are employed. It may be remarked, however, on the other hand, that as the pressure is small, and acts on the cylinders externally, the machinery may be made comparatively light. Rotary engines on the ingenious principle of the Earl of Dundonald, in which the moving parts pursue an uninterrupted course in complete circles, might be easily adapted to the purposes of pneumatic locomotion where the pressure is slight and the machinery is not affected by heat; and being capable of progressive acceleration far beyond what could be safely attained with reciprocating pistons, they would be admirably suited for rapid travelling.* Another strong recommendation for the use of rotary engines is that this construction obviates the necessity for cranked axles, and thus greatly diminishes the risk of accident to this important part of the machinery. To obtain the greatest possible advantage from expansion, double cylinder engines should be employed. As pneumatic locomotive engines of the above description would be extremely light, compared with common steam locomotives of equal power, any requisite weight of goods or passengers could be conveyed on the locomotive itself, as the machinery will occupy little space, and is of course perfectly safe from the danger attending steam.

Having shown, as I hope satisfactorily, that pneumatic locomotives might be used with advantage, I will now give a slight sketch of some peculiarities which give the proposed system strong claims to public notice.

In common with the atmospheric railway, it is free from the danger and inconvenience attending locomotive steam engines, and equally enables us to employ steam as a prime mover in its cheapest and most advantageous form; while, by working expansively, the pneumatic engine gives great advantage in economy of power.

No section valves are requisite, and we thus obviate at once what is anticipated to be of some practical difficulty in the atmospheric railway, namely, the passage of the piston from one section of the pipe to another. The absence of section valves presents other important advantages, among which may be named the greater distance at which the stationary engines may be fixed, *as two engines instead of one will be acting*

* It will appear evident, that the progressive ɪotion of the slide maintains a constant communi-ation between the interior of the pipe and the ɪcomotive cylinders, while its peculiar form and ɪode of action are calculated to give the requisite ɪcility of motion without risk of leakage, as the tmospheric pressure causes a constant and close ɔntact of its surfaces with those of the long valve ɪnd its seat.

* Engines of this construction, and of dimensions suited for common locomotive purposes, might make 300 revolutions per minute with eas and perfect safety, and this rate of working woul with wheels of six feet diameter, give a velocity more than sixty miles per hour.

*on the locomotive in every part of its course, and its distance from a stationary engine can never exceed half the distance between any two engines.**

In the atmospheric railway two methods only present themselves for modifying the speed, or stopping the train, namely, by the application of brakes, which must always involve some degree of inconvenience, if not of actual danger, when the motion is rapid, or by admitting air in front of the piston, which would often cause considerable loss of power. In the pneumatic locomotive the speed may be modified, or the train stopped with the same ease as in common locomotives, simply by regulating or stopping the passage of air to the cylinders. The motion can also be reversed with equal fcaility.

The greatly diminished risk of collision gives a value to the atmospheric railway, which, by the proposed pneumatic system, cannot be obtained without modifying some of its peculiar advantages; still the risks of collision which it may involve are much less than with common locomotives. To take a case of the greatest danger: suppose two trains to be approaching each other on a single pneumatic line, it is evident that the stationary engines on each side will have a double quantity of air to exhaust from the pipe; consequently the rarefaction will be less complete, and the motion of both trains proportionately slower. This will necessarily diminish the danger from collision, and the reduced speed of each train would indicate the probable vicinity of the other, and the consequent necessity for increased vigilance. A provision might be made to cause, either automatically or by hand, a free admission of air to the pipe in case of serious accident to a train; but as this would affect the entire line, it would be desirable to obviate all danger of collision at that particular part, while the remainder of the line should remain effective. This can be attained by having valves in the pipe near the stationary engines, which should be closed whenever the vacuum gauges indicated an unusual admission of air. The tube would thus be, for the time, divided into sections, but without the disadvantage of the atmospheric section valves, inasmuch as no piston has to pass them, and the accident to the train would affect only that one particular section; while the continued depression of the vacuum gauge would telegraph the accident at the neighbouring station.

In the atmospheric railway the propulsion does not depend on the adhesion of the wheels to the surface on which they roll, and the inclination of the road is limited only by the tractive power exerted by the piston. This is, perhaps, one of the most striking advantages of the system, but it is restricted to certain limits by mechanical and physical difficulties. To take advantage of the benefits which this construction of railway presents by diminishing the necessity for easy gradients, the surface of the line will, in most instances, present a series of undulations, regulated on the one hand by the surface level on which the railway is laid, and on the other by the tractive power which can be exerted by the piston. However perfect the casting, and accurate the fitting of the joints, the interior of the pipe cannot be supposed to be truly cylindrical, or to present a very smooth surface, and the fitting of the piston cannot therefore be so accurate as to prevent much loss from leakage, without incurring, on the other hand, a considerable loss of power from excessive friction. The loss of effect from leakage will, of course, be inversely as the velocity of the piston; and as, in ascending a steep inclined plane, the piston must move at a comparatively slow rate to obtain a maximum effect of traction, the loss of power from leakage will be in proportion to the inclination. Moreover, with pipes of moderate diameter, the utmost power of the piston could not overcome more than a certain inclination with heavy trains, and steep descents would be inadmissible, although, in descending a steep inclination, the atmosphere might perhaps be excluded from the back of the piston to such an extent as to check the force of gravitation.

It has been stated that the pneumatic engine must work expansively to obtain a maximum economy of power, but on an ascent it would be advantageous to work at full pressure, thus increasing the tractive force at a temporary expense of power, which, however, would be compensated by the reduced admission of air to the cylinders during the corresponding descent or succeeding level. If requisite, the engines might easily be made to *exhaust* on a steep descent, and the force of gravitation would thus be partially counteracted, while, at the same time, it is made available as an equivalent source of power.

It has been stated in some descriptions of the atmospheric railway, that no delay takes place in performing any given journey, by making a moderate number of stops for a short time each, because, after the train has overcome its "vis inertiæ," it will move forward at whatever rate the air in the pipe is being withdrawn by the pump; and although the motion of the train must be

* Thus, if the stationary engines on the atmospheric railway are three miles apart, this distance may be doubled by the pneumatic locomotive system, and the engines may be placed six miles apart with equal effect.

retarded in approaching a station, stopped altogether there for a short time, and again only slowly resumed, yet all this time the action of the air-pump continues, and the result is a greater rarefaction in the pipe, which gives a corresponding increased velocity to the train, until the power and the load mutually counterbalance each other. But this view of the case is theoretical, and although the statement is correct in the main, it must in practice be considerably affected by leakage, which being inversely as the velocity of the piston, would cause a loss both of time and power as a necessary result of stoppages. By the pneumatic locomotive system we should obtain an accurate fitting of the piston with the least possible friction, by employing short cylinders of the most perfect workmanship, to produce the dynamic effect, the office of the pipe being merely to connect these cylinders with the exhausting machinery; and in case of stoppages, no leakage from the pistons can take place, as the ingress of the air to the engines is entirely prevented. On a double line of road the pipe would be laid between the lines, and should be furnished with a double valve extending its entire length. From the result of experiments on a small scale, I am inclined to believe that, when accurately constructed of elastic impermeable materials, presenting smooth surfaces, these valves will be found to be tolerably free from leakage, and not subject to be affected by atmospheric causes.

Some practical difficulties might be anticipated from the cold produced by the rarefaction of air, but I am led to infer, from experiments made with various degrees of rarefaction from one quarter to three quarters of an atmosphere, that the working of the machinery would not be perceptibly affected by this circumstance, which indeed is partly counteracted by the heat evolved by friction.

The foregoing hasty sketch gives only an imperfect outline of a system which may soon be more fully developed, should it meet the approbation of the scientific public.

ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

WILLIAM DENLEY, OF HANS-PLACE, SLOANE-STREET, BRICKLAYER, *for certain improvements in the construction of fireplaces, flues, and chimneys.* Patent dated September 21, 1843; Specification enrolled March 21, 1844.

A main air flue is proposed to be carried up each chimney, from the bottom to the top, communicating at the bottom with the external atmosphere, and from this flue the air is to be conducted by branch pipes, firstly below the different fireplaces in order to afford combustion and support, and secondly to certain hollow breast-plates or chambers placed above the fireplaces, where, becoming rarefied, it will pass into the chimney, and thereby promote the draft.

Mr. Denley farther proposes, ignorant apparently of what has been before proposed over and over again by others, that the flues or chimneys should consist of a series of fireproof earthenware tubes or pipes, either round, oval, or of any other convenient form, set in brickwork, and that they should be glazed inside to prevent the adhesion of soot or dust.

Lastly, each chimney is to have a downward flue, meeting with each fireplace, through which it can be swept or cleaned, and the dirt and ashes removed without the necessity of entering the different apartments.

JOHN AINSLIE, OF REDHEUGH, NEAR DALKEITH, NORTH BRITAIN, FARMER, *for a new or improved mode of drying tiles, bricks, retorts, and such like work, made from clay and other plastic substances.* Patent dated, September 30, 1843; Specification enrolled, March 30, 1844.

The patentee states that the present manner of drying clay formed into tiles and other articles, at the ordinary temperature and rate of motion of the atmosphere, is a difficult and tedious process at many seasons of the year, so that during the winter season the manufacture of such articles is either altogether or in a great measure suspended. Now it is well known that the drying depends on the rate of evaporation of the water contained in the substances to be dried, that is, on the rate at which the water can be converted into vapour, and on the removal of the vapour so generated; the former of which depends on the temperature, and the latter on the rate of motion of the surrounding air, or of the current to which the substance to be dried is subject. Also, in order to dry any substance with the greatest rapidity, the vapour must be removed as fast as it is formed, so as to prevent the evaporation being checked by the presence of accumulated vapour. Mr. Ainslie's invention consists in the application of the above principles to the manufacture of tiles, bricks, or similar articles, so as to be able to carry on such manufacture at all seasons of the year. For this purpose the clay is placed (when formed and ready to place on the shelf to dry, according to the present process of manufacture) in a close chamber, heated to an artificial temperature, and through which a current of air is made to pass by mechanical or other means. The chamber which the patentee has hithert used is built of bricks, and so situate ar arranged that the clay is taken from tl machine or mould by which it is formed in

the required shape, and is placed in a wagon or frame of shelves, which frame travels along a railway. When the frame is filled, it is run into the close chamber and left there, subject to the artificial current and temperature, until the clay is sufficiently dry for burning. The time required for this process will vary according to the nature of the substance and form it is put into, and on the temperature and current to which it is subject. A temperature of about 80° Faht., and a current of about six feet per second, have been found most advantageous for that purpose; but these may be increased, taking care always that they be not too high, so as to crack the clay in drying. The close chamber may be heated by flues at the bottom and sides, or by hot water and steam pipes, or by the admission of heated air through small apertures, cold air being let into the chamber at other apertures, so as to mix with and regulate the temperature of the heated air. The warm atmosphere of the chamber may be set in motion by the draft of a chimney, or fanner, worked by steam, horse, or other power. Or the current may be created by injecting or withdrawing the air by pumps, the mechanical detail for that purpose being well understood.

The patentee declares that he does not claim the exclusive use of the constructions, arrangements, and adaptations hereinbefore described, except when the same are used in connection with, and for the purposes of his said invention of drying plastic substances in a close chamber at an artificial temperature, and under a current of air, as above described.

William North, of Stangate, Surrey, Slater, *for improvements in covering roofs and flats of buildings with slate.* Patent dated October 5, 1843; Specification enrolled April 5, 1844.

These improvements consist in using battens of slate, combined with slate covers for roofs and flats of buildings, whereby the slabs of slate used in covering roofs, &c., are not fixed to the rafter or joists, as is usual, and the joints of the slates are prevented from becoming defective. The battens of slate are dropped into notches or recesses formed in the rafters or joists, and the ends of the slabs of slate rest on the battens, and are imbedded in putty. The battens or fillets are connected by screws and nuts to the slabs, and these screws and nuts also combine the slabs and fillets to the slate battens. The whole covering of slate is thus bound and fixed together without being fixed to the rafters or joists.

The *claim* is, to combining the use of slate battens with slate coverings for roofs and flats of buildings.

The Great Gun of the "Princeton" Steamer.—The following history of the large gun which, by its bursting, was the cause of the dreadful catastrophe on board the United States' steamer *Princeton*, is given in the report of the Naval Court of Inquiry appointed to investigate the causes of the accident:—"In the year 1839 Captain Stockton, being in England, his attention was attracted to the extraordinary and important improvements which had recently been introduced into the manufacture of large masses of wrought iron, as a substitute for cast iron, for objects which required a combination of strength and adhesiveness, or toughness. Large shafts for steam-engines had been thus fabricated, which experience had demonstrated to be superior in those qualities which were desirable, to the same articles manufactured of cast-iron. These circumstances appear to have led Captain Stockton to consider the question how far the same material might be employed in the construction of cannon of large calibre. He appears to have been animated by motives the most patriotic, stimulated by the laudable desire of being himself instrumental in promoting the honour of his country, and of elevating that branch of the service with which he was personally connected. After much deliberation and several consultations, with calculations furnished from the same quarter, Captain Stockton determined upon the construction of a gun of the proposed dimension, for the purpose of testing the opinions of scientific men by the results of experience. A cannon was accordingly made at the Mersey works, of Yorkshire iron, which, being approved, was shipped to the United States. Having been properly prepared for the purpose, this gun was carried to Sandy Hook, and subjected to what was deemed the proper test. After the first firing, preparations were made to mount the gun. In doing this a crack was perceived opposite the chamber, which induced Captain Stockton to have the breech strengthened by putting bands around it. These bands are represented as being three and-a-half inches in thickness. With this additional strength given to the defective part of the gun, the experiments were renewed, and the result was a decided conviction upon the minds of all connected with them, that, in general, the anticipations of Captain Stockton were perfectly realized; and, secondly, that if a gun of this construction should yield to the force of the trial, it would be by a simple opening, and not, as in cast-iron, a violent disruption and scattering of the fragments. The success of these experiments was such as to decide Captain Stockton forthwith to direct the construction of another gun of a similar character, to be made of American iron, which is usually regarded as superior in strength and tenacity to the English iron. This second gun (the same which exploded on board the *Princeton*) was constructed with a chamber similar to that of the first gun, with an additional thickness of 12 inches at the breech—a difference, even if the metal were only of equal goodness, far more than sufficient to compensate for the bands by which the first had been fortified. Application was made to Colonel Bomford, of the Ordnance Department of the Army, who, it is well known, has been professionally occupied in experimenting upon guns of a large calibre, and his opinion requested as to the proper proof to which such a gun ought to be subjected. The new gun constructed by order of Captain Stockton exceeded in dimensions and weight, consequently, should also have surpassed in strength, that contemplated by Colonel Bomford, they being of the same calibre, and the proof to which this cannon was subjected was much more severe than what was proposed as sufficient by that experienced officer."

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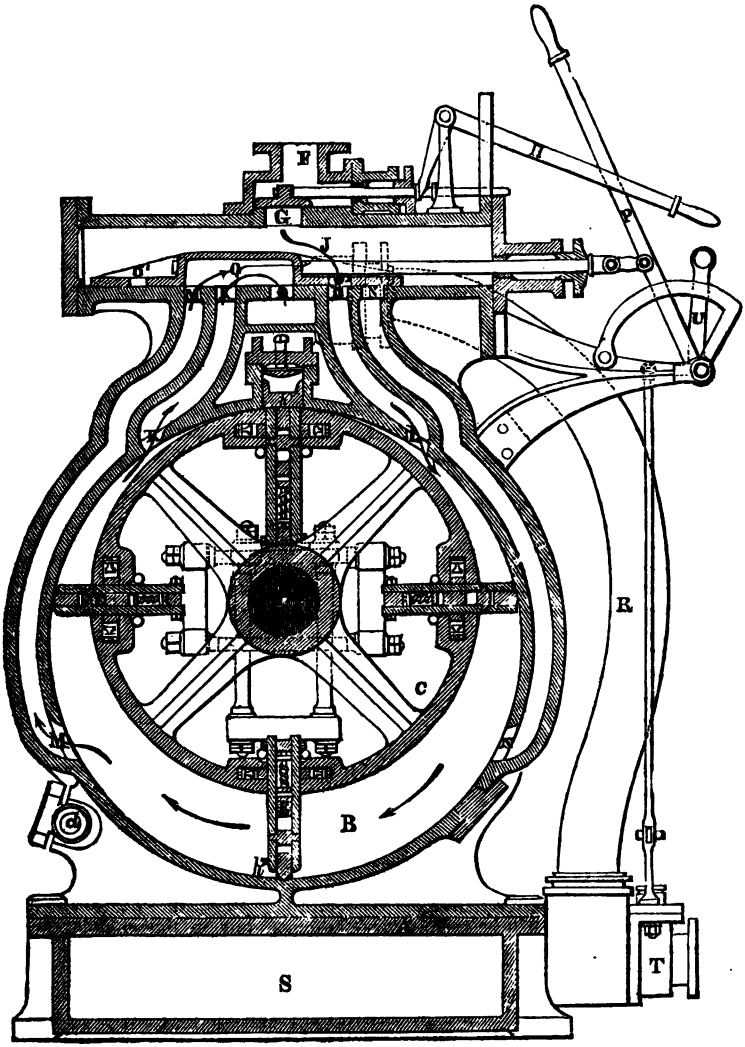
MR. BORRIE'S PATENT REVOLVING STEAM ENGINE.

Fig. 1.



MR. BORRIE'S PATENT REVOLVING STEAM ENGINE.

[Patent dated August 3, 1843; Specification enrolled February 3, 1844.]

Figure 1 of the accompanying engravings is a transverse section of this engine through the centre of the cylinder, and figure 2, partly a transverse section through the centre of the air-pump, and partly an end elevation of the other parts of the engine.

A is the foundation plate, to which all the parts of the engine are directly, or indirectly, attached.

B is an external cylinder, fixed to the foundation plate.

C is a small cylinder, revolving within the external one, on a shaft D, whose centre is placed so far above that of the external cylinder, that their circumferences may touch one another at the upper point h^1, and the space between them thus gradually increase from h^1 to the lower point h^2.

The shaft D passes through steam-tight stuffing-boxes in the cylinder ends, and revolves in bearings in the frames Z Z, which are firmly bolted to the foundation plate, and stayed to the cylinder.

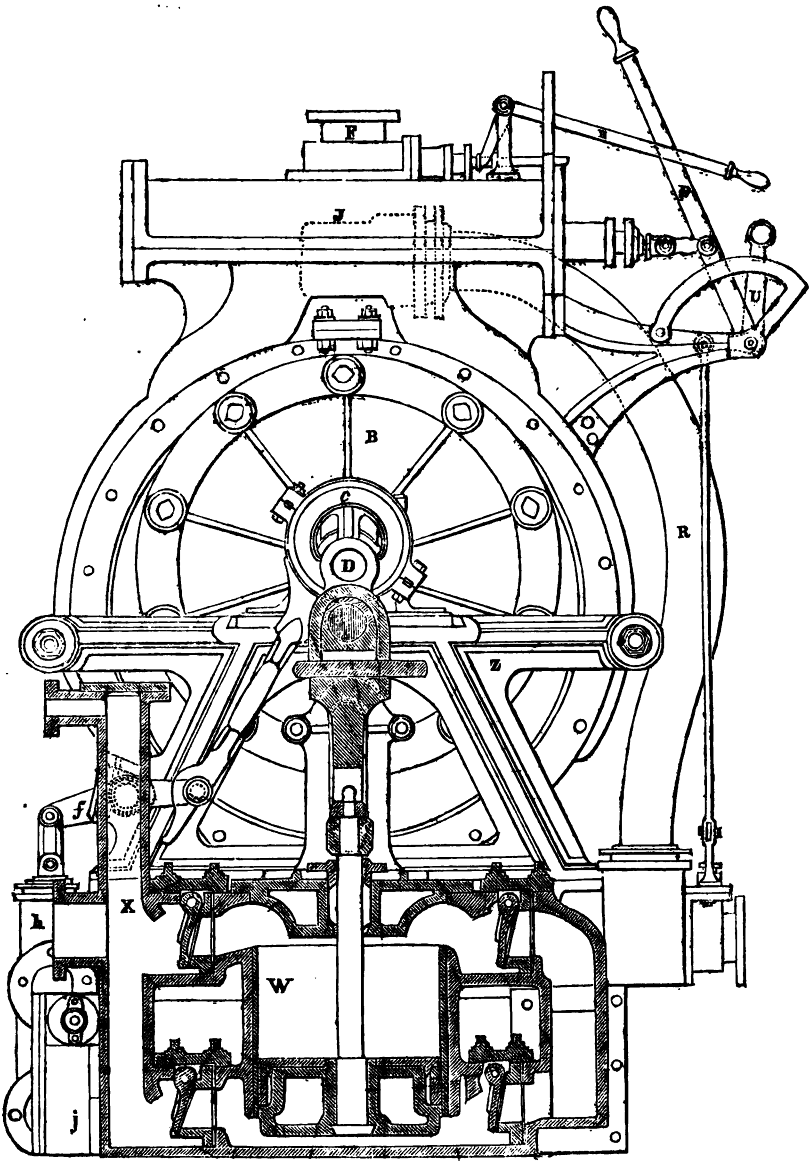
E E are two sliding pistons, consisting each of two arms, connected together by four rods passing over the shaft. Their breadth is equal to that of the outer cylinder, and their joint length over their extremities is necessarily somewhat less than its diameter, owing to the eccentricity of the revolving cylinder. These pistons slide freely at right angles to one another, through passages made in the circumference of the revolving cylinder, their sliding motion being caused by the pressure of one of their extremities on the ascending side of the outer cylinder, (whichever side that may be), and the eccentricity of the revolving cylinder through which they slide. As their length is always slightly varying during the course of a revolution, the difference is made up by metallic packing placed between the two thicknesses of plates, of which the arms of the pistons are composed. This packing is pressed by springs towards the sides and circumference of the outer cylinder, as will be readily understood by reference to figures 1 and 2. In the passages in the inner cylinder, through which the pistons slide, there are also metallic packings which are pressed on the flat surfaces of the pistons by springs, and prevent the steam passing to the interior. There are besides two steel rollers at the inside of the packings, which are pressed up to the flat sides of the pistons by screws, for the purpose of diminishing the friction of their sliding motion, but the inventor considers that these rollers would not be necessary except in large engines. The rim of the inner cylinder is made to project into metallic packing boxes in the cylinder ends, whereby the steam is entirely prevented from passing into the interior of the inner cylinder. A packing-box is also placed at the point of contact h^1 to prevent the steam passing to either side. From what, as has been stated, it will be perfectly understood, that the steam only acts on the projecting part of the sliding pistons, between the inner and outer cylinders.

The steam in coming from the boiler, through the steam-pipe F, has first to pass the slide G, which is worked by the handle H. After passing that slide, it enters the steam-tight jacket J, the bottom of which is the slide face, having the four cylinder ports K, L, M and N, and the eduction port Q, on it. A slide O, worked by a handle P, passes over these ports for the purpose of reversing the motion of the engine; on this slide there are two ports O^1 and O^2. In the position which the slide is shown in the engravings, the port O^2 is open to the steam port L, the port N is closed, and the two ports M and K are open to the eduction port Q, so that when the slide is in this position, the engine will necessarily move in the direction indicated by the arrows. Now by moving the slide along until the port O^1 is above the steam port K, then the port M will be closed, and M and L open to eduction, so that the steam will act at the opposite side of the cylinder, and consequently the motion be reversed.

It will here be observed, that the lower cylinder ports M and N are *never* used for admitting steam, but only for leading off the used steam. The object in placing them so low in the cylinder is to allow the vacuum to act upon the pistons sooner. It must be kept in mind therefore, that, in whatever direction the shaft revolves, the steam is always admitted at one of the upper ports K or L, and the used steam led off at its opposite lower and upper

ports. All these ports where they lead into the cylinder are divided by bridges placed diagonally across them, so that the pistons may pass freely over them.

Fig. 2.



From the relative position of the two cylinders and the distance between their circumferences gradually increasing from contact at the upper point h^1, to th

greatest distance at the lower point h^2 (which in this case is $\frac{1}{8}$th of the diameter of the external cylinder, but may be varied according to circumstances,) it follows that in whatever direction the engine revolves, the area of that part of the pistons which is acted on by steam and vacuum gradually increases, so that the principle of expansion is carried out to its full extent, without the aid of expansion valves and gear.

The steam passing through the eduction passage Q is conducted by the eduction pipe R to the condenser S. T is the injection slide, placed at the lower end of the eduction pipe, and conducting the water up the pipe, so as to act fully on the steam in passing downwards; it is worked by a lever and rod connected to the handle U, which is placed in proximity with the other starting handles H and P.

V is the blow-through valve.

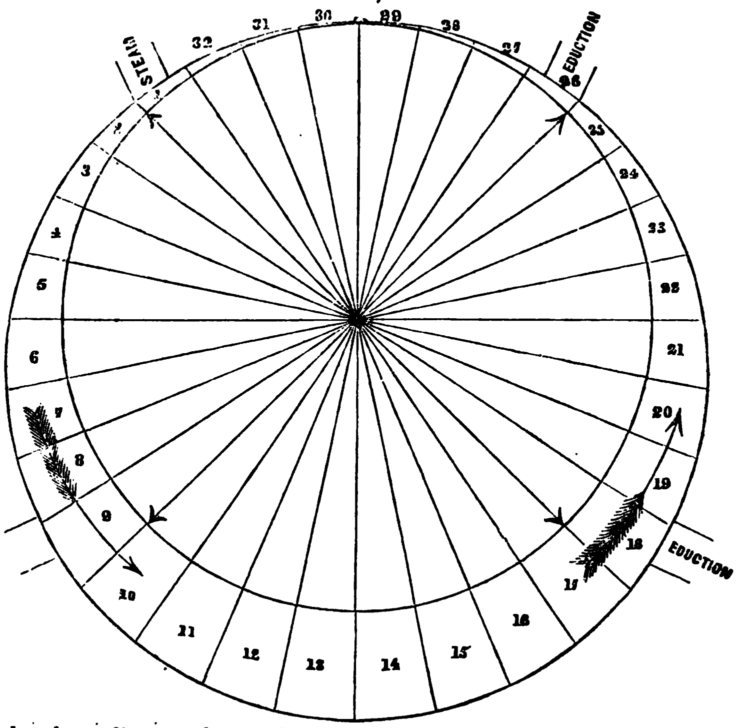
W is the air-pump, which is a double-acting one. The interior arrangement of its valves, &c. is shown in figure 2. It has a metallic packed piston which is worked from the main-shaft by a crank and connecting-rod, and the piston-rod is kept parallel by two slide-guides bolted on the air-pump cover.

X is the hot well, and Y the discharge passage.

The pumps are worked from the main shaft by an eccentric *c*, connected by rod and lever to a rocking-shaft *d*, on which are keyed two levers *e* and *f*, which are connected by rods to the pumps *g* and *h*. The pump *g* is intended for the bilge water (in the case of marine engines) and the pump *h*, for feeding the boilers. The latter has its valve chest *j* bolted on the hot well.

The following able "Analysis of the Economy and Power" of this Engine, as compared with other engines, has been obligingly furnished to us by the inventor, Mr. Borrie.

ANALYSIS, ETC.



In the above diagram the revolution of one piston is divided into thirty-two equal parts, and the Table B shows the quantity of steam consumed; the

mean area of the piston; the distance the centre of pressure of the piston travels; the direct, opposite, and effective, pressures on the piston; the number of times to which the steam is expanded; and the number of lbs. lifted one foot high, in passing through each of these divisions. The external cylinder is 3 feet 6 inches diameter, and 1 foot 6 inches long inside; and the greatest distance between it and the internal cylinder, is 7 inches. The steam is supposed to be at a pressure of 30 lbs. on a square inch, above the atmosphere, and the vacuum to be equal to 12 lbs. on the square inch, the shaft making 50 revolutions per minute.

The direct pressure or force of the steam to turn the engine round in the required direction, is marked on the Table + pressure, and the opposite, or force resisting the motion in that direction, — pressure: of course, their difference, is the effective pressure.

TABLE B.

Divisions.	Steam consumed in cubic inches.	Mean area of piston in square inches.	Distance the centre of pressure travels in feet.	Pressure on Piston.				Number of times the steam is expanded	Number of lbs. raised 1 foot high.
				+ Pressure per square inch in lbs.	— Pressure per square inch in lbs.	Effective pressure per sq. inch in lbs.	Whole effective pressure on piston in lbs.		
1	126·0	15·8	0·291	44·5	44·5	0·00	0·00	—	0·000
2	72·6	21·0	0·291	44·5	36·47	8·03	168·6	—	49·0
3	108·0	30·0	0·3	44·5	31·12	13·38	402·0	—	120·6
4	145·8	40·5	0·3	44·5	27·3	17·2	696·6	—	209·0
5	194·2	52·5	0·308	44·5	24·3	20·2	1060·5	—	326·63
6	246·2	64·8	0·317	44·5	22·25	22·25	1441·8	—	457·05
7	304·2	78·0	0·325	44·5	21·09	23·41	1826·0	—	593·45
8	367·2	91·8	0·333	44·5	20·41	24·09	2212·3	—	736·7
9	380·0	100·0	0·341	44·5	20·00	24·5	2450·0	—	835·45
10	Steam cut off }	111·6	0·341	36·47	7·5	28·97	3232·0	1·22	1102·1
11	—	120·0	0·35	31·12	2·5	28·62	3434·6	1·43	1202·0
12	—	124·5	0·35	27·3	2·5	24·8	3807·6	1·63	1080·6
13	—	126·0	0·358	24·3	2·5	21·8	2746·8	1·843	983·35
14	—	126·0	0·358	22·25	2·5	19·75	2488·5	2·0	890·88
15	—	124·5	0·35	21·09	2·5	18·59	2314·4	2·11	810·0
16	—	120·0	0·35	20·41	2·5	17·91	2149·2	2·18	752·22
17	—	111·6	0·341	20·00	2·5	17·5	1953·0	2·225	665·97
18	—	100·0	0·341	12·00	2·5	9·5	950·0	—	323·95
19	—	91·8	0·333	2·5	2·5	0·0	—	—	—
20	—	78·0	0·325	2·5	2·5	0·0	—	—	—
21	—	64·8	0·317	2·5	2·5	0·0	—	—	—
22	—	52·5	0·308	2·5	2·5	0·0	—	—	—
23	—	40·5	0·3	2·5	2·5	0·0	—	—	—
24	—	30·0	0·3	2·5	2·5	0·0	—	—	—
25	—	21·0	0·291	2·5	2·5	0·0	—	—	—
26	—	15·8	0·291	2·5	2·5	0·0	—	—	—
27	—	9·0	0·285	—	—	0·0	—	—	—
28	—	3·6	0·28	—	—	0·0	—	—	—
29	—	—	0·26	—	—	0·0	—	—	—
30	—	—	0·26	—	—	0·0	—	—	—
31	—	3·6	0 28	—	44·5	—44·5	—160·2	—	—44·8
32	—	9·0	0·285	—	44·5	—44·5	—400·5	—	—114·1

From the Table the following results are obtained:—

The quantity of steam required for one revolution of each piston = 1944·2 cubic inches.

Distance the centre of pressure of the piston travels in one revolution, 10·065 ft.

Average effective pressure on the piston 1080 lbs.

Greatest expansion, 2·225 times.

Number of lbs. raised 1 foot high, by the revolution of one piston, 10980.

Momentum of one piston	10980 lbs. raised 1 foot high.
Number of pistons	4
Momentum of one revolution	43920 lbs. raised 1 foot high.
Number of revolutions per minute	50
Momentum per minute	2196000 lbs. raised 1 foot high.
Deduct for friction, say 10 per cent.	219600
Effective momentum per minute	1976400 lbs. raised 1 foot high.

$$\frac{1976400}{33000} = 59{\cdot}9 \text{ horses power.}$$

The quantity of steam consumed by a revolution of one piston, is 1944·2 cubic inches.

Number of pistons	4
Steam required for one revolution	7776·8 cubic inches.
Number of revolutions per minute	50
Steam consumed per minute	388840·0 cubic inches.

Steam at 30 lbs. pressure on a square inch above the atmosphere, is 609 times the volume of the water of which it was generated, therefore,

$$\frac{388840}{609} = 638{\cdot}5 \text{ cubic inches, or } 37 \text{ cubic}$$

feet, quantity of water evaporated for steam per minute.

In a common double-acting condensing engine of the same power, the effective momentum will be the same, on 1976400 lbs. raised 1 foot high per minute, and if we take Tredgold's data that the effective power is ·63 of the power of the steam, it will stand thus:

$$\frac{1976400 \times 100}{63} = 3137143 \text{ lbs. raised 1 foot}$$

high.

If the pressure of the steam on the piston be equal to 35 inches of mercury, or 2·4 lbs. on the square inch; and the vacuum the same as in the revolving engine, or 12 lbs., then the pressure on the piston will be 14·4 lbs. on the square inch, and $\frac{3137143}{14{\cdot}4} = 217860$ = the product of the area of the cylinder in inches, multiplied by the velocity in feet, and $217860 \times 12 = 2614320$ cubic inches.

The loss of steam in filling the passages and spaces at top and bottom of cylinder, say $\frac{1}{12}$ 217860.

Cubic inches of steam required per minute = 2832180.

Steam at a pressure of 2·4 lbs. on the square inch, is 1497 times the volume of the water of which it was generated, therefore, $\frac{2832180}{1497} = 1892$ cubic inches, or 1·095 cubic feet = the quantity of water required for steam, per minute, $\frac{1892}{638{\cdot}5} = 2{\cdot}96$ times the evaporation required for the common engine, as for the revolving engine, and consequently, only about one-third of the fuel would be required for the revolving engine, as would be required for a common reciprocating engine of the same power.

Peter Borrie, Engineer,
8, Princes-square, St. George's East,
London, March, 1844.

SMOKE-PREVENTING FURNACES.

Sir,—At a time like the present, when remedial measures for the abatement of the Smoke Nuisance are so prominently before the public, every information really tending to elucidate this important subject must prove highly beneficial to manufacturers and the community at large. The means by which this desirable object may be attained have been long partially understood, that is, that it may be effected by admitting *air* to the burning mass of fuel, and the aeriform products of such fuel, whether wood, coke, or coal. Watts admitted air; Parkes admitted air, and smoke-burners in general have admitted air for 50 years past up to the present time; in short, every clever stoker will assert that he can burn smoke by leaving his bars a little bare, or allowing his fire door to hang ajar a short while after firing. What mystery, it may be asked, is there,

then, in "smoke burning?" The whole mystery consists in the *mode* of supplying the air, a matter so ably discussed in your valuable journal, by C. W. Williams, Esq., and so scientifically treated in his work on *The Combustion of Coal, and the Prevention of Smoke*, that I deem it superfluous to do more than notice briefly, that, as every measure of coal-gas, say every cubic inch, requires the enormous quantity of ten cubic inches of air, to supply the needful quantity of oxygen for its complete combustion without the evolution of smoke; and in like manner every cubic inch of coke-gas, or carbonic oxide, requires 5 cubic inches of air for the same reason, it becomes almost self-evident that the best, indeed the very best, *mode* of admitting that air into the furnace, to effect its mechanical diffusion, in the hot atmosphere of gaseous products, is to divide it into numerous small jets or films, as first claimed by Mr. C. W. Williams's patent of 1839, and afterwards* by Mr. Samuel Hall in 1841, 1842.

To show how much misconception exists on this subject, we have only to refer to the *Mining Journal* of last Saturday, wherein a correspondent, signing "A Manufacturer," addresses a letter to the Editor, dated Birmingham 3rd inst., in which he states that Mr. Muntz, of Birmingham, has "*effectually accomplished what he thought was impossible,—viz. to consume the smoke from his 'muffles,' and this he has effected by Mr. Samuel Hall's patent.*" Having had several communications with Mr. Muntz, and heard his evidence before the select committee on Smoke Nuisance, in July last year, I feel assured that the above statement is incorrect. Mr. Muntz is well satisfied of the possibility of getting rid of the smoke from muffles, but he is not so well-assured that it will ever be attended with *economy;* and in regard to some particular processes in which these muffles, or annealing furnaces, are used, it is generally believed, that the carbon, &c. of the smoke is rather beneficial, than otherwise, in its effects on the metals within the muffle. Then, in the next place, we are informed of the plan being "Mr. Hall's patent," whereas he has a plurality of "smoke-burning" patents, dating 1836, 1838, 1841, and 1842. But it so happens that the plan adopted by Mr. Muntz, by Mr. Gillott, steel-pen manufacturer, and by other parties in Birmingham, is *not* "Mr. Hall's patent," but merely a revival of the plan employed twenty-six years ago by Messrs. J. and P. Taylor, of London, of which I shall now furnish full particulars, from Thomson's Annals of Philosophy, vol. 12, for 1818, not doubting it will be read with considerable interest. It is as follows:—

* Mr. Hall asserts that he has a prior claim for jets of air: if we admit he has a prior claim, the question naturally arises, by what law does he reclaim "jets of air" in 1841, 1842?

On the Construction of Fire-places to Steam-Boilers. By John and Philip Taylor, Civil Engineers.

72, Upper White-cross-street, May 6, 1818.

The annexed sketch exhibits the construction which we have lately used in the erection of fire-places to steam-boilers, and which seems to combine some advantages, so as, perhaps, to render it worthy a place in your journal; at the same time we are aware that there is little in it that can be called absolutely new.

We were desirous in the first place to remove the fuel from the possibility of actual contact with the bottom of the boiler, which sometimes happens from the carelessness of the men; and still more to avoid, if possible, the injury accruing from the sudden influx of large portions of cold air from frequent opening of the fire-door. The contraction caused by this sudden diminution of the heat, is apt, in some cases, to disturb the joints of the plates, where high degrees of temperature are used, and to render them leaky.

We have avoided both these evils, by removing the fire from under the bottom of the boiler, and placing it, as in the drawing, in a furnace, at one end, whence the flame reverberates through a flue passing under the vessel to be heated. As the cold air, which at times may be admitted, comes first into immediate contact with a mass of heated brickwork, and is mixed before it passes through the opening into the flue, by which the whole is, as it were, wire-drawn together, so united as to render the changes of temperature more gradual.

The front of the furnace is provided with an inclined hopper, as shown in the engraving, (fig. 1), which is to be kept full of coal at all times, preventing the passage of any air that way, and the fuel may be occasionally pushed forward into the furnace without much breaking through it. This mode of feeding boiler fireplaces has been used before, and with advantage, and particularly where the coal is of such a quality as not to cake much, in which case it has been found that it supplies

the consumption for a long time with very little trouble, and without admission of cold air. With Newcastle coal it will not go on so regularly, but acts very well with a little assistance.

The hopper is made of cast iron; but the lower part of it, which is in contact with the fire, is terminated by Welsh or Stourbridge lumps. Under it a small door is placed, which serves to permit the introduction of a bar to break up the fire occasionally, or to cut out the clinkers.

The furnace is further provided with apertures for the introduction of air, so as to consume the smoke, the situation of which may be observed in the two sections.

In the lateral one (fig. 1) may be seen where two enter the furnace on one side; *the number, of course, may be increased at the option of the builder;** and in the transverse section (fig. 2) the mode of conducting the air is exhibited.

It has been very judiciously observed, that when cold air is admitted in a direction parallel to the current of the smoke, it frequently passes with it into the chimney without inflaming it, the two streams running as it were together without mixing, in such a manner as is required to produce the effect. To have the inflammation complete, the air should be as hot as possible, by which, also, the least check is given to the action of the fire; and the current should cross that of the smoke where they meet, by which such a mixture of the two is produced as is required for the intended purpose.

Fig. 1.

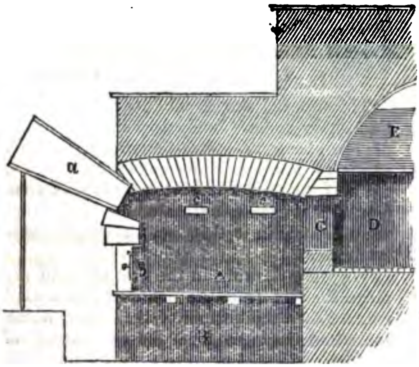
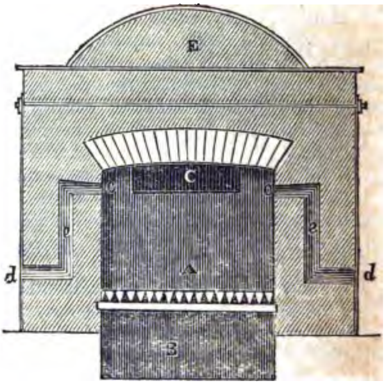


Fig. 2.



The air in this furnace is first admitted by small passages in its sides, which are fitted with registers, and passes horizontally so as to strike against the back of the fire-bricks lining the fireplace, behind which it rises until it is turned through small apertures into the furnace. The vertical passages may be extended considerably in a lateral direction, so as to present a great heating surface to the air, which also will serve to increase the durability of the fire-bricks by keeping them cool at the back. The air enters so as to cross the current of the draft; and the opening into the fire is so made as to direct the influx towards the centre, and to prevent it from from striking the arch, which otherwise would be injured by it. The quantity of air is regulated at pleasure by the registers; and it is obvious that it will always pass into the fire in a heated state, which seems to be essential to the speedy inflammation of the smoke.

We are, &c.,

JOHN AND PHILIP TAYLOR.

Description.

Fig. 1. Lateral section, showing the furnace or fire-place, under which the flame passes through a semicircular flue to the chimney at the other end. A, fireplace; B,

* This remark of leaving the most important part to "the *option* of the builder," aptly illustrates an observation made by Mr. Williams, in his Treatise on *Combustion*, and the truth of which some engineers have affected to doubt, when he says,—"To this day, the construction and arrangement of the furnaces, in our manufactories, and under the boilers of the steam-engines, are in the hands of bricklayers, working boiler-makers, and other individuals ingenious in their respective departments, but who should not be expected to be acquainted with the details of another department so different as that of *Chemistry;* and whose habits of business cannot have led them to investigate or study chemical agencies and processes; yet, on these agencies is the *whole question of the efficacy of a furnace dependent.*"—8vo, 1841, p. 14.

ash-pit; C, throat of the furnace; D, flue under the boiler; E, boiler; *d*, the hopper for coals; *b*, door for stoking; *c c*, passages for heated air to consume the smoke.

Fig. 2. Transverse section, in which the same letters refer to the same parts as in fig. 1.

d d, entrances for air to inflame the smoke; *e e*, vertical passages behind the linings of the fire-place, through which the air ascends and becomes heated.

"A Manufacturer" would have done well to have made himself acquainted with the facts of the case, before publishing statements injurious to Mr. Hall, by placing him in the light of laying claim to the above old invention; when, even supposing he had unwittingly claimed as his own, it is very clear he could not legally sustain any such claim.

This plan of Messrs. Taylor is totally unsuited for locomotive and marine boilers, as in them the air passages must be formed of pipes passing *through the water spaces*, thus becoming a refrigerating medium, of which sufficient proof was given in experiments on the "Star," and other locomotives, when a plan similar to this was tried by Mr. Hall*. Other objections are, that the voluminous admission of crude air cools the flues, whence arises the necessity of using extra fuel to make up for the deficiency of heating effect. Another, and equally serious evil, is the necessity, in brick furnaces, of building the sides hollow, thereby greatly endangering the safety of the boiler seating; besides, that the hollow brickwork is constantly out of repair whenever there is anything like heavy firing. This plan, however, is more particularly objectionable for wagon boilers, which are often set on fire lumps, through which holes cannot be made, and consequently, grooves are cut in the top, so as to admit streams of air through apertures closed at top by the two legs of the boiler itself, where all the sediment is known to settle; and here a stream of r must play directly on the iron surface ıder the powerful influence of an in:nsely-hot furnace, than which nothing ın be more reprehensible. On this lan, too, diffusion becomes less perfect s furnaces increase in width, especially s the recommendation of contracting the ıroat or bridge can seldom be adopted.

All these difficulties are easily and effectually overcome by Mr. C. W. Williams' Argand Furnace, in which no stream of air exceeds a jet of half an inch in diameter, and is as superior to all other *modes* of admitting air, as one gas-burner is superior to another, simply by causing a better and more perfect combination of the gas with the air; and Mr. Williams has likewise the great merit of being the first to point out in his Treatise, and other writings, the nature, object, and necessity of this his mode of giving the largest possible surface to the admitted air; the fallacy of heating the air; and the absence of scientific principles in all mere "smoke burning" expedients.

I am, Sir, your obedient servant,

HENRY DIRCKS.

77, King William-street, City,
April 15, 1844.

* See Evidence of Mr. Dewrance before a Select ommittee on Smoke Nuisance, 1843.

THE ATMOSPHERIC STEAM-ENGINE, AND THE "SAPPHIRE."

Sir,—In the Number of your highly useful Magazine dated the 16th March, I read a letter signed "Curve," alluding in terms of great praise to the *Sapphire*, a new vessel employed in the passage between Gravesend and London Bridge, and propelled by atmospheric steam-engines.

The writer of the letter just referred to gives his opinion respecting the important and extremely interesting subject of the causes that influence the speed of steam vessels, so much in the manner of a person intimately acquainted with the subject, that I am induced to ask him (through the medium of your Magazine) for the information of myself, and others much interested in steam navigation, whether he wishes it to be understood that he attributes the great speed of the vessel in question, to the use of the atmospheric engines as there applied; and if so, in what manner the great results he speaks of are obtained?

The letter of "Curve," read in the usual manner, leads one to the conclusion that atmospheric steam-engines, worked with very low steam, are the best adapted for vessels where a high rate of speed is the principal object.

I have hitherto, in common, I believe, with most other persons, entertained the opinion that atmospheric engines must be larger, and consequently heavier, than engines of equal nominal power on the usual plan, besides being less economical in working than the double acting engines of Mr. Watt; also, as by common acceptation they *consume*, they must, of necessity, als *carry* more fuel with them than is necessa

for the ordinary engines, which is also against speed.

In common with several other persons, I feel anxious to see some reply from Messrs. J. and F. Napier to the question of "Observer," in your Magazine No. 1073, as to the manner in which they had ascertained the speed of the *Isle of Thanet* to be 18½ miles per hour, and will thank you to draw their attention to this.

I am, Sir, your obedient servant,
A STEAMBOAT PROPRIETOR.

London, April 15, 1844.

PRESERVATION OF LIFE AT SEA—MR. GIBSON'S PNEUMATIC PROTECTORS.

Sir,—With much pleasure I saw in your Magazine of March 30, an account of a universal plan for preventing ships and boats from foundering at sea, and consequently rescuing human life and property, *to a vast extent*, from the jaws of ocean. This has been a subject too long neglected by all parties, whether legislatorial, commercial, philanthropical, naval, or mechanical; and yet simple in the extreme, as has been exemplified in your Magazine by Mr. W. H. Gibson, in the application of pneumatic bags and compressed air, applied to the sides of all craft, whether large or small, between the timbers, (or anywhere else,) and covered with a plank lining, so that when the boat or vessel is fitted with its pneumatic apparatus the observer would be at a loss to discover any visible difference between that and any other ordinary craft. Sir, this has long been a plan of construction I have devoutly wished to see adopted, and, when in general use, will completely alter the present state of maritime affairs. Though not deficient in the knowledge of pneumatics, the world is deficient in their general application to the principles of science engendered by them, and wants a spur on the subject. The atmosphere is a very cheap substitute for coals, coke, and other fuel required by our monster steam-engines, more effective, and less dangerous. Atmospheric railways will supersede steam railways, and pneumatic ships will shortly put steamers into the shade. Mr. Gibson deserves great credit. We want not a life-boat—one solitary, expensive, cumbrous craft, new built for a specific purpose, but we want thousands; we desire all ships and boats to be life craft, everywhere in readiness to save life and property on the shore and on the seas. We want no new craft; the pneumatic bags, as Moses says, "will make old shipsh and boatsh better ash neo." Such would prove as efficient, or more so than the present ones for all general purposes, and never could sink, capsize, or founder while a timber holds together. Poor fishermen might go to sea in any weather with impunity, and for a few pounds their boats would prove as safe a refuge as Noah's ark. Yacht clippers might be built in any form, shape, or fashion, and might carry sail till all 's blue, without fear of being taken aback, and going down stern foremost. Old merchant ships, hardly worthy of being classed as A 2 or B 1, would look up again; give them Gibson's pneumatic bags, and the insurance companies at Lloyd's would run little risk of being sufferers. In fact, the invention embraces such a wide scope, that it would take a whole day to state their presumed advantages, and more space than the *Mechanics' Magazine* can afford. The principle is good, the execution of it is simple and cheap, and all who may travel on the waters should bless such a humane project as is hereby presented to them. By means of it, ships and boats may be made as safe from sinking as balloons, and naval and commercial men may realise many advantages hitherto unregarded, or considered as impossible. In this hope, Mr. Editor, I leave you, and have the honour to remain,

Your most obedient servant,
JOHN BEACHCROFT DIXON.

Washington-street, Somers Town,
Chichester.

Mr. Dixon's favourable opinion of Mr. Gibson's plan may be considered of the more value, that he is himself not only a gentleman of great nautical experience, but has devoted his special attention to the subject of preservation of life at sea. Four years ago he addressed to the "Philanthropists of the United Kingdom," a circular on the subject, from which we extract the following forcible observations.

"I wish to impress on the minds of those in power, the utter carelessness or indifference of ship-owners in not providing sufficient means of preservation from the dangers of the sea, and more especially as regards boats. I have made three voyages to India in ships, sometimes crowded with passengers, sometimes with troops, and in one case with both; and I can safely aver that in each separate ship, had any calamity taken

place at sea, either by fire, wreck, or otherwise, the greatest number of us, if not all, must have perished. The boats on board merchant ships are for the most part ill constructed, and, from want of care, are too frequently in a very bad state. The long-boat or launch (if they have one) is generally a clumsy, unwieldy machine, and in a heavy sea would be very unsafe and unmanageable, especially if crowded with passengers, and the requisite provisions for their sustenance. It is usually employed as a sort of farm-yard, and stowed with all sorts of dead and live lumber between the main and fore masts, and its seams, from want of care and caulking, generally admit water like a sieve. The cutters, pinnaces, and jolly-boats are not more secure: but supposing they were all sea-worthy, in many cases they would be found incapable of containing one half of the human beings on board. Some ships carry their full complement of boats, some only a long-boat and jolly-boat, some a cutter and jolly-boat, and in one instance I went down the Mediterranean in a large bark with a jolly-boat only.

"It is but just to notice a striking exception; I allude to the boats of whalers. These ships are always well found and well manned, and their boats are of a different build, and in sufficient quantity. They have their respective crews with an officer appointed to each on leaving port, and in case of accident each man knows his own boat and station. Confusion is thus avoided, and every officer of course looks after the well-being of his own. Why should not this be the case in every ship? Had the *Lord W. Bentinck*, the *Castlereagh*, or the *Thames* possessed each two or three large life-boats, the greatest part, if not all of those on board, would have been preserved.

"I think, then, I am justified in saying that the Government of this country has not sufficiently taken this subject into consideration, and that there is ample scope for the exercise of its legitimate power."

THE VESTA LAMP.

*Report of Photometric Experiments upon Young's Vesta Lamp, with spirits of turpentine, to determine the cost and quality of illumination, compared with the best oil lamps and candles. By Andrew Ure, M.D., F.R.S., &c.**

The Vesta Lamp, burning with its utmost brilliancy, without smoke, emits a light equal to very nearly twelve wax candles of three to the pound, and it consumes, in that case, exactly one pint of spirits of turpentine in ten hours, value 6*d.*—hence, the cost per hour for a light equal to ten such candles is ½*d.*; whereas, that from wax candles would be nearly 6*d.*—from stearine, 4½*d.*—from Palmer's spreading wick candles, nearly 3*d.*—from tallow moulds, 2½*d.*—from sperm oil, in Carcel's mechanical French lamp, 1½*d.*—thus: The Vesta Lamp ½*d.*; Carcel's Lamp, 1½*d.*; Palmer's Candles, 2½*d.*; Stearine Candles, 4½*d.*; Wax Candles, 6*d.*

But one great advantage of the Vesta Lamp is the snowy whiteness and purity of its light, which is, therefore, capable of displaying the more delicate colours of natural and artificial objects, flowers, paintings, &c., in their true tints, instead of the degraded hues visible in them by the light of candles and ordinary oil lamps.

The size of the flame from which so much light is emitted in the Vesta Lamp is greatly smaller than that of gas or oil argand flames of equal intensity—a difference to be accounted for from the great difference in the chemical composition between spirits of turpentine and fat oils. The spirits consist entirely of carbon and hydrogen—88½ carbon, 11½ hydrogen, in 100 parts—and thus consume per cent. 328 parts of oxygen. Sperm and other unctuous oils consist of 78 carbon, 11¼ hydrogen, and 10¾ oxygen, in 100 parts, which require for consumption only 287·2 of oxygen, because the oxygen already present in the oil can itself consume, without emission of light, 2·6 of carbon and 9·4 of hydrogen—thus leaving only 85·5 parts of combustible elements for the atmosphere to burn. For this reason 87½ parts, by

* The *Vesta* is the name given to the first (we believe) Camphine Lamp, which has had such success, that upwards of 16,000 have been sold within the last three months. Mr. Young, the patentee, states the following to be the distinctive features of his invention:—"My lamp is constructed for burning highly rectified spirits of turpentine, or camphine. The liquid is always kept cold in the lamp, preserved from any possibility of being heated, or warmed. No tube or metal connecter of any description is allowed to pass into, or through the liquid, from the burning part of the lamp. A perfect non-conductor, of wood or other proper material, is placed between the burner and the liquid. The cotton is suspended from the burner, and hangs down in the spirit, sufficient in itself for the capillary attraction without the assistance of tubes or any conductor of heat to the liquid. The air for the support of the interior of the ring of the flame is passed in between the wick on an entirely new principle: thus not only avoiding the necessity of a tube to convey air from the underside and through the liquid, but savi[ng] the nuisance of the oil cup as well as the expens[e]

weight, of spirits of turpentine will consume as much oxygen as 100 parts of sperm oil, and will afford a more vivid light—because they contain no oxide in them, as fat oil does, to damp the combustion. In the spirits of turpentine, the affinity of the elemenrs for oxygen is entire; whereas, in fat oils, it is partially neutralised beforehand—just as spirits of wine would be if mixed with water.

THEORY OF PARALLEL LINES.

Sir,—Whilst, as in other journals, the theory of parallels has sometimes been discussed in your pages, it has hitherto been principally the sides and angles of triangles which have been reasoned upon, or employed for that purpose, and more rarely the areas. But with the view of furnishing the means of turning the areas to better account, a demonstration of the following curious theorem has been given in No. 72 of the *Edinburgh Philosophical Journal*, viz:—If one triangle had the sum of its angles different from two right angles, so would every other, and the difference (as in spherics) would always be proportional to the area.

This is prefaced by an expectation that it will yet lead to a satisfactory demonstration of Euclid's axiom. An obvious inference drawn from it in the paper just cited, is, that a sufficiently large triangle would have the sum of its angles either less than nothing, or amounting to three right angles, which are conclusions alike absurd. But in the attempt to construct a triangle having any proposed area, it seems to have been assumed that the angles of an equilateral triangle can never be inapplicable, or, which is the same thing, that in any circle a finite number of chords, each equal to the radius, could always go quite round the centre. On the evidence in favor of this last will therefore depend the soundness of the inference referred to.

DELTA.

Glasgow, April 13, 1844.

MR. BAIN'S ELECTRIC PRINTING TELEGRAPH.

The disputes between Professor Wheatstone and Mr. Bain as to the legal and moral standing of each in the matter of electro-telegraphs and electro-clocks has already been noticed by us at some length. We have no intention of alluding to that dispute further, on the present occasion, than to remark that it has not deterred Mr. Bain from pursuing the subject. Having completed a telegraphic apparatus, he has profited by the liberality of the directors of the South Western Railway Company to fix it on their line, and to exhibit it at the Nine Elms Station to a great number of gentlemen interested in railways, and in the progress of science. The apparatus transmits signals to and from Wimbledon, a distance of *six miles;* its action, while we witnessed it, was extremely rapid, and very certain; every message (indicated by numbers) was transmitted and returned correctly, the process of printing it going on in the meanwhile.

This important invention has some peculiarities which require to be separately noticed, before a correct idea of their joint effect can be obtained. 1st, It is now well known that if a metallic communication be made in one direction between the distant parts of an electrical apparatus, water, or the moist earth, will serve safely for that in the other or returning direction. Some part of the dispute before-mentioned referred to the priority of the discovery or application of this fact; and it turned out that neither of the present disputants was really the first who had observed it, although Mr. Bain certainly had re-discovered it. But the latter named gentleman has made another, and more important advance. In the former case the earth was merely found to be a safe medium for *transmitting* the electric fluid. He has now found that a considerable length of moist soil may be made to *generate* electricity enough to work a telegraph, by merely burying in the ground, or immersing in water, at two distant points, a sufficient surface of positive and negative metals, and connecting them by an insulated wire. In this manner is obtained the electrical power which controls Mr. Bain's telegraph. A copper plate being placed in water at London, and a corresponding zink one at Wimbledon, the two being connected by a single copper wire, the artificial galvanic battery is entirely dispensed with. We may here add that Mr. Bain has found that, the greater the length of moist soil comprehended between the metallic surface,

the more intense is the electric current obtained, although it is of less quantity. He finds also that this terrestrial electricity is very constant in its intensity. It is found that the telegraph can be worked with metal plates of only 4 square inches each, making 8 square inches of surface in each. The plates actually employed are each of one foot square.

2ndly, Electro telegraphs have chiefly hitherto been immediately actuated by the deflecting power of the galvanic current. If a needle, which freely vibrates on a centre, is placed in the middle of a coil formed of many convolutions of insulated wire, in such a manner as that it is parallel with the plane of the coil, and can vibrate freely, and if an electric current be directed along the wire, the needle will be deflected from its original position, and this deflection will take place to the right hand or the left, just as the current may pass, in one direction or the other, along the wire. A variety of contrivances have been employed for indicating, by the motion and direction thus given to several needles, the message intended to be transmitted by the electric telegraph. The indication depended on the deflection of the needle by the immediate action of the galvanic force. In some, however, a weight was employed to move the machine, and the motion thus obtained was interrupted by bringing into action the parts of an electro-magnetic apparatus at the distant end, by means of wires connected with a corresponding apparatus at the end from which the signal was made. In Mr. Bain's new telegraph the machine is actuated by weights, but its motion is stopped by a detent, until interruption of the galvanic current is made to release it at the pleasure of the operator at the other station. The acting power is here not in the electric current, but in the weight and the current is required to be only of the trifling energy necessary to ve the controlling detent under very all pressure.

Each telegraphic system on Mr. Bain's in consists of the plates and single re already described, and of two ichines, exactly alike, one at each the two stations, between which e communication is to be made. The ichines themselves form part of the tallic connexion between the plates. long as the electric current flows without interruption, the machinery is quiescent, being locked by the detent; but the instant the connexion is broken, the detent makes a slight rotation, by which the clockwork is disengaged, and the signalizing commences. It is preferred, and with good reason we think, to make the rest of the machinery—not its motion—depend on the continuance of the connexion, since any failure of the electrical apparatus is then instantly brought to notice by its putting the machine in action.

The electro-magnetic apparatus, which is employed solely to actuate the detent, is constructed as follows:—A light vertical spindle carries a brass bar, on each extremity of which is fixed by the middle of its length a semicircular magnet, the ends of the two magnets nearly touching each other, and the magnets themselves nearly completing a circle of which the spindle is the centre. Two insulated wooden bobbins affixed to the frame of the machine, are bored out large enough longitudinally to admit the magnets to pass through them without touching, and they carry the coils of wire which form part of the electric route. They are placed longitudinally to the magnets, and so that the ends of the latter meet within their central cavities. When the electric current is made to pass along these coils, the magnets, with their spindle, are made to rotate through a small arc in one direction; as soon as the current is interrupted the power of these coils ceases, and a constant magnet, placed at a little distance, brings back the electro-magnets and their spindles to their original position. A protuberance on that spindle fulfils the office of detent, being cut on one side nearly to its centre; the extremity of a long light arm, which is carried by one of the last arbors of the clockwork, and therefore revolves rapidly, rests on this protuberance when it is in one position, and passes by its flat side when in the other.

Each machine consists of three parts, that which gives motion to a hand like that of a clock; that which on the pointing out of a telegraphed figure, strikes a bell; and that which prints the figure. Supposing now the machine to be set agoing, by having made the necessary electrical disposition for releasing the detent, we observe first that the hand rotates in front of a dial, its point pass

ing by the nine digits, a cipher, a large dot, a vacant space, and its starting place, arranged in a circle; next we see that, on the hand being stopped at any figure, by breaking the electrical connexion, its part of the machine stops, the striking part begins to go, and soon strikes a spring bell, and the printing apparatus acts so as to leave an impression of the figure at which the machine was arrested on a piece of paper wound round a revolving cylinder on the left of the machine. This is repeated for any figures, or any number of them, which may have been desired. When the communication is closed, the same is done with the dot or period. After waiting, perhaps, half-a-minute, the machine begins to go again, apparently of its own accord, but really by the action of the assistant at Wimbledon, and the same figures are repeated by the hand stopping at each of them, and printing it, and sounding the bell also as before. The same interruption of the electric current which stops the machine at one station, stops also at the same instant that at the other; and as the hands of the two machines are originally set together, and afterwards revolved at the same speed, it is obvious that the figure at which one is stopped will be pointed out at the same instant by the other. The printing is effected by types projecting radially from the periphery of a wheel. The types are so disposed on the periphery, and the wheel is so geared to the machinery which carries the hand, that when a given figure is pointed out on the dial, the same is presented by the wheel to the paper. The type wheel is pressed forward to imprint the figure on the paper.

The two machines, we have said, are exactly alike. The velocity of their rotation is regulated by small governors like those used in steam engines, and it is necessary that the machines should pretty exactly agree in this respect. If, however, any error of this or any other kind should occur, so that the two machines do not point to the same figure at the same time, it is instantly discovered by the following contrivance. The machine, if left to itself, would stop at any one of the figures or spaces; it goes only so long as the attendant keeps in due order the requisite metallic circuit. But to this there is one exception, that of the vacant space which we spoke of as forming part of the circle in which the figures are disposed; here the machine would not stop of itself. Now if the two machines arrive at this space at the same time, they will both pass over it without stopping; but if one of them points to this space, while the other points to a figure, a stop will there take place, by virtue of the action of the latter machine, and the attendant at the other then instantly perceives by the improper stoppage on the vacant space, that the instruments do not agree. It is obviously easy to ascertain what is the figure to which the hand of each machine should point to correspond with the other, since it will readily be seen what figure the hand of one machine passes over without spontaneously stopping when left to itself.

This novel and highly ingenious telegraph seemed to us to act with perfect correctness in its construction, and the methods devised for its use. Most effectual precautions seem to have been taken against the undetected continuance of error. We understand that a telegraph of this kind has been at work satisfactorily for the last eighteen months. The importance of the physical discovery on which its peculiar action depends, will not be disputed; and the invention, both in its effect and its details, will necessarily command the attention of the railway world. It is remarkable for simplicity; this, however, distinguishes not so much the mechanical parts, which are always in sight, and subject to ready comprehension and easy repair as the electrical connexion; here a single wire suffices, and a failure, if it were to happen, would be known to belong to that one wire, precluding the delay, vexation, and uncertainty which is occasioned by a like misfortune to one of the many wires required by other electrical telegraphs. Its comparative cheapness, and its facility of management, are important recommend-tions; but a still greater, we think, is th uniformity of its action, depending, as i does, not on batteries, whose power i constantly varying, but on the electricit of the earth itself. We congratulate Mr Bain on this successful exhibition of th results of his long-continued labours and we earnestly trust that neither pirate nor professors will again annoy him.

THE SUN AND PLANET MOTION.

Sir,—Dr. Gregory, in his "Mathematics for Practical Men," page 355, speaking of the Sun and Planet motion of Watt, says, "And some mechanics are apt to think that they are great gainers by this arrangement." The learned author thus evades, as it were, expressing any very decided opinion of his own on the subject, but proceeds to observe that the contrivance is certainly elegant, though in practical utility the common crank is preferable.

Can any of your correspondents point out what those advantages are that are said to be contemplated by "*some mechanics?*" What their nature, and their extent?

I am, &c.,

HEZRON.

ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

RICHARD BOOTE, OF BURSLEM, *for certain improvements in pottery and mosaic work*. Patent dated, October 5, 1843; Specification enrolled, April 5, 1844.

These improvements, which appear to be of a very novel and ingenious description, are classed under four distinct heads.

First, in order to produce coloured designs on grounds of different colours, as, for example, black on white, or white on black, the designs are first made from a mould, in the same manner that is usually followed in what is commonly called figuring. These designs, or rather impressions of designs, are then laid on the moulds from which the piece of ware is intended to be made. That which is to form the ground colour is then put on, which forms closely round the design, and covers the same inside; the design remaining as originally put in, both leaving the mould quite clear and distinct outside. The same process is equally applicable to the manufacture of tiles, bricks, quarries, panels, and slabs of various shapes, as also to various other analogous purposes.

Second.—Another method consists in cutting the design in paper, parchment, or some other such like pliable substance, which is laid in the moulds. The halves e then fastened together, and the colour rhich is to form the ground is poured in, fter which the paper or parchment is removed, and another colour is poured in to ill up the place from which the paper or parchment has been removed, forming the levice and inner lining. It is now allowed to assume the required thickness, when the emaining liquid is withdrawn. After standng a short time, it leaves the mould, bringng out all colours distinct on the surface.

Third, to produce raised figures on a piece of ware of a different colour to that of the ground colour, the figures are carved, or otherwise produced in low relief, on the inside of such plaster of Paris moulds, as are ordinarily used in hollow ware pressing, and the hollow parts filled in with the composition, of which the raised figures are intended to consist, before the halves of the mould are fastened together. When the halves of the mould, with the hollow parts so filled up, are fastened together, the slop which is to form the ground is then poured in, and is allowed to stand till the composition, adhering to the mould, is of the thickness intended to be given to the body of the ware, on which the remaining fluid stuff is withdrawn in the usual way. Should the ground be an expensive colour, the slop is only allowed to remain in as long as is necessary to give a very thin coating to the mould, and then drawn off; after which some other slop of a cheaper quality is poured in, to form the substratum, or inner lining of the piece of ware.

And *fourth*, to produce designs of a mosaic, or other like character: The patentee fixes the design upon the inside of the moulds, before the halves are fastened together in composition of the required varieties of colour. The halves of the moulds are then fastened together, and slop of a colour suited for the groundwork, as black or blue, is poured in, and as soon as the clay has adhered to the mould to the thickness required, the remaining liquor is withdrawn.

JOHN GEORGE BODMER, OF MANCHESTER, ENGINEER, *for certain improvements in grates, furnaces, and boilers, and also in manufacturing or working iron or other metals, and in machinery connected therewith*. Patent dated October 5, 1843; Specification enrolled April 3, 1844.

The improvements specified under this patent are divided into several distinct branches. The *first* has for its object the arrangement of machinery, whereby the bars of furnaces are caused to travel from the front towards the back or further end, carrying the coals along with them, which are deposited thereon from a hopper placed at the front of the furnace. There are two pairs of screws, one pair placed on each side of the ash-pit, and running parallel with its sides, the one pair being placed immediately over the other at a distance of a few inches; the screws are formed of cast-iron, and constitute the bearings for the furnace bars, which are necessarily laid across the furnace. The ends of the bars fall into the threads of the screws, and are carried backward, according to the degree of velocity communicated to them, by the machinery to

which they are attached. The coals for feeding the furnace are placed in a hopper, having a door to regulate the exact quantity of coal that can escape upon the furnace bars; which, as before stated, recede backward into the furnace and carry the coals along with them. The threads upon the screws at the fore part of the furnace are cut regularly, but towards the back they are cut in an irregular manner, technically termed, "drunken threaded," giving to the bars as they move backwards an undulatory motion, whereby the clinkers are prevented from accumulating, and the embers freed from ashes. In case of any clinkers becoming attached to the furnace bars, there is a scraper placed at the further end of the furnace, which clears them off as they arrive at that part. When the bars have come to the end of the screw, they are pressed down by means of a pair of cams from the upper pair of screws upon the under pair, which are of a much coarser pitch of thread; by this lower pair of screws the bars are brought from the further end to the front of the furnace, where they are elevated again to resume their place upon the upper pair of screws. The patentee confines his claim, under this branch, to the improved arrangement and construction of the mechanism as described; claiming, however, in particular a gradually increasing oscillating or rocking motion, and a gradually increasing distance of the grate bars commencing from the hopper.

Under the *second* branch, the patentee states that he means to use steam of a high degree of temperature from boilers adapted to these furnaces, and therefore packs the stuffing-box of the ram of the force pump with metallic packing, consisting of a series of conical rings of brass and tin, or other metal. He claims this arrangement of packing, not only for plungers of high pressure pumps, but also for plungers in coal pits, and for the packings of piston rods of any description, as also their application to air-tight stuffing-boxes of revolving shafts, naves, or bushes of wheels, and cocks or taps, particularly those of larger descriptions.

The *third* branch of the improvements relates to a lathe or screw-cutting machine for cutting the above-described screws or patterns for the same.

The *fourth* branch relates to the application of a somewhat similar furnace to that described under the first branch for the conversion of iron into steel, as also for the smelting of iron and other metals.

In the *fifth* branch the patentee claims the application of his furnace to puddling hearths and to the heating apparatus of blast furnaces.

The *sixth* branch has reference to a method of rolling saw blades. The steel from which such blades are to be formed is first made into a hoop and then passed between rollers, whereby it may be rolled to any required thickness without being removed from the rollers, and ground on the surface and edges.

NOTES AND NOTICES.

Milner's Fire-Proof Safes.—The efficiency of these safes, of the construction of which we gave a description in our 893 No., was verified last week in a very conclusive manner by some experiments made for the purpose, at the Camden Station of the London and Birmingham Railway. From the report given on them in the first Number of the *Railway Record*, (a very promising specimen of this new paper,) we extract the following striking instance:—"Early in the morning about one ton of coal, and the same quantity of wood, were piled upon an open foundation of bricks, within which (the fire) was placed a Bankers' Safe of double 2½ in. chambers, containing books and papers. The pile was lighted at half-past eight, and quickly burned up. Shortly after one o'clock, the safe was removed and examined. Although taken out of a bed of red heat, the inner chamber and contents were, after five hours' trial, quite cool and perfect as when put in. The bankers' safe was again placed in a strong fire, and with two short intervals of a few minutes for examination, kept there till eight o'clock, p.m.; when it was finally removed, quite red hot outside, but the inner chamber and contents perfectly fresh and unaltered."

Immense Lens.—At a recent meeting of the Paris Academy of Sciences, M. Guinant laid on the table a lens of flint glass *twenty inches* in diameter, which exceeds by six inches the famous lens in the telescope of Pulkowa, the largest previously in existence.

Self-acting Mercurial Ventilator.—At the last meeting of the Society of Arts, Mr. Wroughton described a new sort of ventilator which he had constructed. A mahogany vertical frame, 17 inches high, and 14 inches wide, stands on a platform 14 inches long, and 18 inches wide; in the frame is fixed a plate of glass, in which are ten horizontal apertures, each 2½ inches long, and ½ inch wide; on the internal side of the glass are four vertical brass slides, in which work as many pieces of glass, fixed in a brass case, as there are apertures in the plate, but somewhat larger, in order entrely to cover them when necessary. The two sets of glass covers are suspended from a small brass beam, working on a pivot attached to the glass. A small ivory piston, working with a nut and screw, in a glass bent tube, is attached to one set of glass covers. The glass tube contains a column of mercury, altogether about 12 inches in length, but divided at top into two arms, over which are two vertically placed glass tubes, about 10 inches in length, and bent over at top, and returning down to the bottom of, and close to the first tubes; these tubes are filled with spirits of wine, which when expanded by heat, acts in conjunction with the mercury (with which it is in contact), and elevates and depresses the glass covers, so as to admit fresh air in proportion to the amount required to keep the temperature of the apartment at a fixed point, which is ascertained by a scale marked on the glass plate.

The French Copper Balloon, constructed by M. Marey Monge, is stated to be composed of sheets of copper, the 200th part of an inch in thickness, which are connected together by bands like the ribs of a melon, having been soldered together by means of Delbruck's autogenous process, a full description of which appeared in our No. 872. It is about 10 yards in diameter, weighs 800 lb., and will contain 100 lb. of hydrogen gas.

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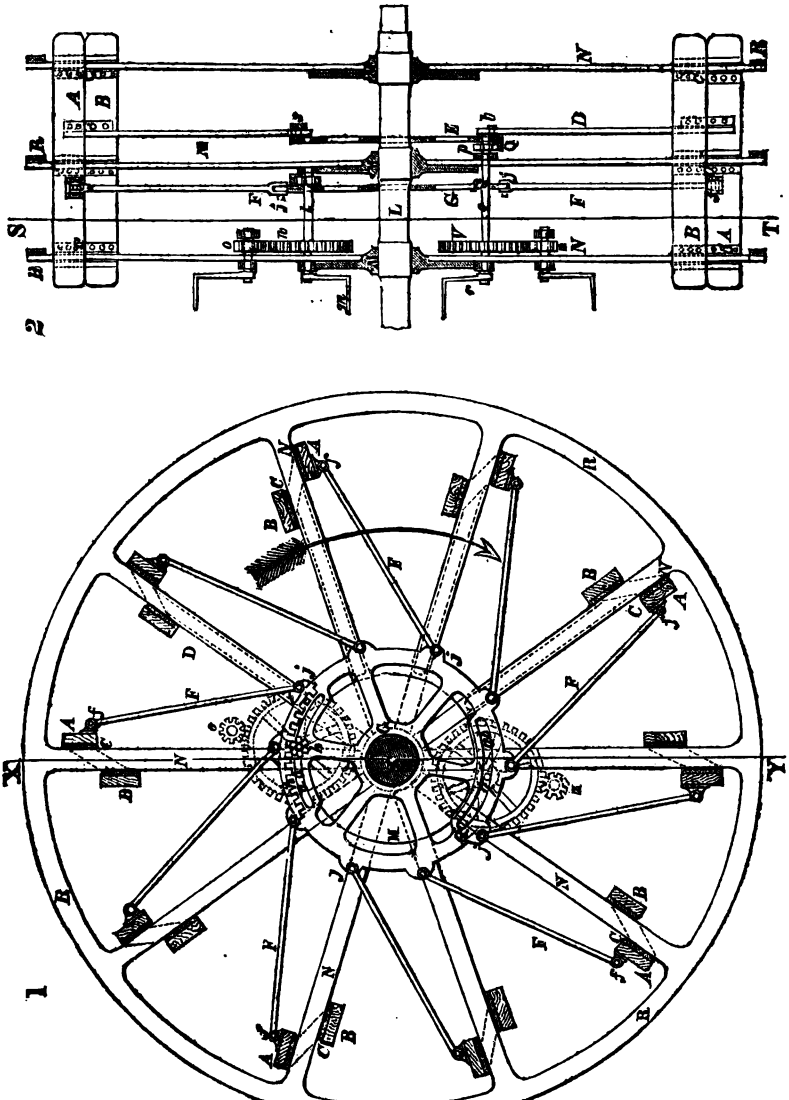
BRUNET'S PATENT PADDLE-WHEEL.



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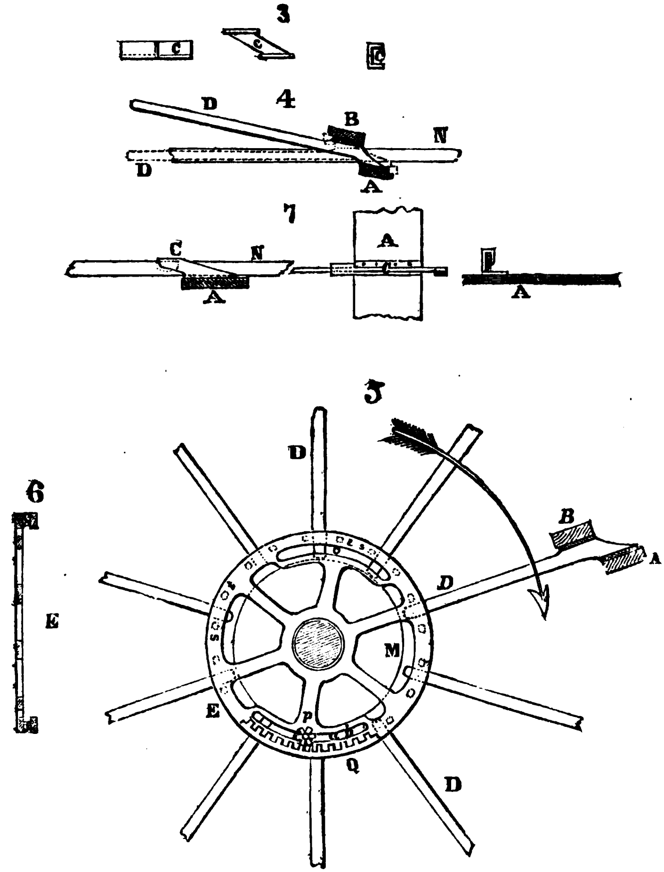
BRUNET'S PATENT PADDLE-WHEEL.

[James Joseph Brunet, of Limehouse, Esq., patentee. Patent dated, July 6, 1843; Specification enrolled, January 5, 1844.]

The peculiarity of this paddle-wheel consists in a very ingenious, and, we doubt not, equally efficient arrangement for causing the floats to be protruded only at those points in each circle of rotation where they can exert a propulsive force, and withdrawing them at the others, or, in other words, enabling them to be reefed and unreefed at pleasure. Fig. 1 of the accompanying engravings is a sectional side elevation, and fig. 2 a transverse sectional side elevation of a wheel on this plan; fig. 1 being taken on the line S T of fig. 2, and fig. 2 on the line X Y of fig. 1; and parts in both figures, which are unnecessary to the proper understanding of the nature of this part of the invention, being omitted.

L is the paddle shaft; M M the bosses, or centre pieces; N N N the arms, and R R the outer rim or periphery. To each arm there are two floats, A and B, one placed on the front, and the other on the back of the arm, but in different planes, so that the inner edge of A shall shall nearly coincide with the outer edge of B. Instead of being bolted to the arms, as usual, these floats are kept in their respective positions, and locked or unlocked in their positions in manner following. Each pair of floats is connected together by a diagonal or cross piece, C, separate views of which are given in fig. 3; and to each pair of floats so connected together by the cross piece, is attached a lever, D, by the raising or depressing of which (by the means to be afterwards explained), the floats A and B are disengaged from the arms, or locked fast upon them in the manner particularly shown in fig. 4. The lever D is free to move as far inwards as the shaft of the wheel, and to the extent to which it is drawn in or protruded, the float at its outer end (being disengaged, as aforesaid) will, of course, be also drawn in or protruded. To regulate these two modes of action of the lever D, two wheels, E and G, are made use of. The former wheel is called the "compressing" wheel, and the latter the "reefing" wheel. Both wheels turn freely on the paddle shaft, and are about the same size. The wheel E, which is separately shown in fig. 5 (a side elevation), and fig. 6 (a section), has two rims, which are connected together by pairs of studs, or pins, *s t*, *s t*. The inner or free end of each of the levers D passes through the open space between the opposite or corresponding studs *s t*, in the wheel E, so that while it is left free to move inwards or outwards, should the wheel be turned round, either in the direction of the arrow in fig. 1, or the contrary way, the studs *s t* are caused to press upon the lever, and so to raise or depress it, and thereby to disengage the floats A and B from the arm N, or lock them fast upon it. The distance from the periphery at which the floats are from time to time fixed is determined, and the keeping of them at that distance effected, by the reefing wheel G, and its appendages. F F F are a number of diagonal connecting rods, which are attached at one end, by the joint *j*, to the wheel; and at the other end, by the joint *f*, to each pair of connected floats A B, so that, supposing the floats to be disengaged from the arms in manner before explained, when this wheel, G, is turned round in either direction, it draws in or pushes out the floats to the extent desired, and requires only to be made fast to keep the floats in the positions so assigned to them.

For the more convenient turning round of the wheels E and G, the following additional gearing is employed. In the case of the wheel E, there is a circular rack Q, fixed near to its periphery (see figs. 2 and 5), into which works a pinion *p*, keyed upon a spindle *q*, that is supported by bearings from the paddle-wheel arms, and projects beyond the side of the wheel; *r* is a winch handle, which fits on to the spindle *q*, and by which the pinion *p*, and consequently the wheel, is turned round. In the case of the reefing wheel G, the additional gearing employed is of precisely the same description as the preceding; *h* being the circular rack; *k* the pinion; *l* the spindle; and *m* the winch handle. The power over the wheels may, if found expedient, be still further increased by adding to the outer ends of the spindles, *q l*, toothed wheels, V *n*, with second pinions, *z* and *o*, working into them, as shown in fig. 2; transferring, of course the winch



handles r and m, from the ends of the main spindles q l, to the ends of the spindles of the second pinions z and o. And as one or both of the spindles, g l, may have to intersect the planes through which the two wheels E and G move, circular spaces, a b, a b, are made in the body of those wheels which allow of their turning perfectly free of the spindles.

From the description which has been so far given of the parts of this wheel, the mode of proceeding, when it is desired to reef or unreef the floats, will be readily understood. The first thing to be done is to turn the compressing wheel in the direction contrary to the arrow in fig. 1, by applying the winch handle r to the projecting end of the spindle q, (or spindle of the pinion z, as the case may be,) whereby the levers D D D are raised, and the several pairs of floats, A B, are disengaged or unlocked from their respective arms. The reefing wheel G is then, by applying the winch handle m to the end of the spindle l, (or of the spindle of the pinion o, as the case may be,) turned either to the one hand or the other, according as it is desired to draw in or push out the floats. And after the floats have been so brought to the particular distance from the periphery at which it

is desired to work them, the compressing wheel is then turned back in the direction of the arrow in fig. 1, which, depressing the levers D D D, causes the floats to be locked fast at the positions assigned to them upon their respective arms. The compressing wheel must be held fast by a catch, or other suitable means. The wheel is then in a state of complete fitness for use.

Instead of pairs of floats being employed, single floats may be substituted by modifying the arrangements before described, in the manner represented in fig. 7. All that will be necessary in that case will be to form the connecting diagonal cross-piece C into a sort of hook, by means of which the single float may either clasp the paddle arms closely, or be disengaged from it when acted on by the lever D.

WIRE ROPES.

[From the Journal of the *Franklin Institute* for March.]

This interesting species of cordage is fast superseding, in many situations, that formed of hemp.

Wire ropes were, more or less, used in the French navy so long as twenty years ago, and public attention being gradually directed to their utility, they were, about ten years since, introduced, to a very considerable extent, into the service of the mines in the interior of Germany, and since then their ascertained merits have rapidly worked their way forward into public confidence.

Soon after the passage of an Act of Congress for the better regulation of steam navigation, which required, amongst other things, that metallic connexions should be employed between the steering wheels and rudders of steamboats, several ingenious men turned their attention to the substitution of wire ropes, for the hempen cordage generally employed. A consequence of this was the manufacture of some very good wire cordage or rope.

The methods of manufacture have been gradually improved until a wire rope is now made in which, without much impairing the initial strength of the wires, a degree of pliancy is retained amply sufficient for every practical object, and almost, if not quite, equal to that possessed by cordage of hemp laid up in the usual manner.

In England, these wire ropes have recently been employed with the greatest success, in mine and railway use, and for the standing rigging of ships. They have received the public approbation of a large number of civil and mining engineers, amongst whom may be found some of the leading men, of these professions, in Great Britain.

The leading manufacturers of wire rope in England, at this time, are Messrs. Smith and Newall, who have each procured patents for their respective processes. Wire ropes, both flat and round, of Newall's manufacture, have been very highly approved, under various circumstances of use.

Thus, on the London and Blackwall Railway, *eleven miles* of this rope has been in constant use for two years. *Six miles* of wire rope on the Brandling Junction Railway, including an endless rope on an inclined plane 1,000 yards long, is said to work very well. *Thirty-seven miles* of wire rope are in use upon the Durham and Sunderland Railway, and are stated by Mr. Blenkinsopp, the engineer, to have *treble* the duration of hemp ropes. On the Oldham incline of the Manchester and Leeds railway, a wire rope has been working very satisfactorily for eighteen months. Upon the inclined planes of the Shrewsbury canal, wire ropes have been at work for two years and a quarter, and Mr. Beech, the engineer, expresses his belief, *that they will last two years longer*, and he states, at the same time, that upon these planes the hemp ropes, formerly used, *never lasted more than two years*, whilst their cost was double that of the wire rope, and their weight four times as great! At the Gosport colliery, near Newcastle, *two flat wire ropes* have been in daily use for four months, without indicating the least wear, their weight, in proportion to hemp, being as twenty-one cwt. to forty-seven cwt. Mr. Rœbling, a civil engineer in this State (Pennsylvania) has directed his attention to wire ropes; he has manufactured some very good ones, and has written some interesting articles upon the subject.

The canal commissioners of Pennsylvania having become aware of the importance of employing wire ropes in the internal improvement service, have put some of them in use upon the state works crossing the Alleghany range, and in their recent report we find the following paragraph:—

"*Wire and Hempen Ropes.*—The ropes for the inclined planes and ferries on the line of our improvements, have hitherto been an enormous annual expense to the state. They are made of hemp, and, upon an average, it is believed that they do not last more than one season. There are ten required for the planes on the Alleghany Portage Railroad, one for the Schuylkill plane, one for the

Millerstown ferry, and one for each of the slips for hauling out section boats at Columbia, Hollidaysburg, and Johnstown. The average cost of each of these ropes is about 2,333·00 dollars, requiring an aggregate yearly expenditure of 35,000·00 merely for cordage to do the work upon the main line of our improvements. It has been an object with the canal commissioners to reduce this heavy expense, if at all practicable. For that purpose they ordered a wire rope for plane No. 3 of the Alleghany Portage Railroad last year, which was used a considerable portion of last season, and the whole of the present year, and which seems to have been but little injured by use during that period. Wire ropes also, but of a lighter size, have been procured for the slips for hauling out section boats at Johnstown, Hollidaysburg, and Columbia, one of which has been in use for two seasons, the other two have done the work for one season. A wire rope for plane No. 10 of the Portage Railroad has also been ordered, which has been manufactured and delivered at that plane, and which will be put on it in the spring."

So far as these wire ropes have been tested, they bid fair to answer the purpose; and if the experiment shall ultimately prove successful, a large annual saving will be made to the commonwealth by their substitution for hempen ropes.

OCCASIONAL FIRE-GRATE.

Fig. 1.

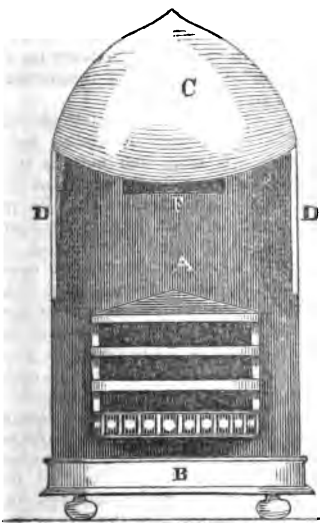
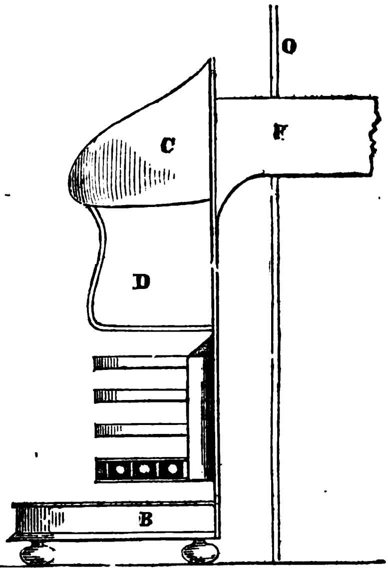


Fig. 2.



Sir,—There are parts of a house which are usually constructed without fire-places, as lobbies, closets, &c., though it is frequently desirable to have the means of warming them by a fire. In such cases a stove is resorted to, the flue of which is conducted outside the house at any convenient place, or made to communicate with the nearest chimney. Many persons, however, dislike stoves, and would prefer an open fire: for these, the prefixed engravings present a convenient and portable form of grate, which I term an "Occasional Fire-grate;" as it is not only suitable to the circumstances and situations mentioned; but, if made very small and light, is also adapted for occasional use in rooms possessing fire-places, in lieu of the ordinary grate of the apartment. When so used, it will o

course be placed on the hearth stone in front of the fire-place, with an opening in the fire-board for the flue to enter and communicate with the fire-place and chimney, as represented at O, in fig. 2. Fig. 1 is a front view, and fig. 2 a side elevation of the grate, of which very little explanation is required. The back plate, A, is supported from the base plate B, which serves as an ash-pan, and for this purpose has a raised rim or border round it three inches high. At the top of the back plate is fixed the projecting hood or canopy C, connected with which are the cheeks, or side-plates D D, also fixed to the back plate, and descending to a line two or three inches above the top bar of the grate. The object of these, and of the canopy, is to guide the smoke into the flue F, and prevent it diffusing itself into the room. The grate is entirely of open bars, without side plates, except two inches next the back, where a fire-brick of that thickness is placed. It will thus be seen, that the fire has an ample radiating range, and will be found to diffuse greater warmth through a room than when made in a grate of the same size placed *within* a fire-place.

I am, Sir, &c.

N. N. L.

April, 1844.

MR. DREDGE'S SYSTEM OF BRIDGE BUILDING.

[A new Bridge over the Clyde at Glasgow, in place of the present defective "Accommodation Bridge," being in contemplation, this has led to the publication, in the *Glasgow Constitutional*, of the following communication from a Mr. William Thomson, in which the merits of Mr. Dredge's system of bridge building are exceedingly well pointed out. We add a letter from Mr. Dredge to Mr. Thomson, containing some useful comments on his letter.—Ed. M. M.]

To the Editor of the Constitutional.

Sir,—With reference to a substitute for the now condemned "Accommodation Bridge,"

* * *

The characteristics of Mr. Dredge's improvement are the adoption (1st) of taper main chains, and (2d) of oblique suspending rods.

I. By tapering the main chains, (*i. e.*, gradually reducing the number of parallel bars in each link from the abutment towers to the centre of the bridge,) these chains are relieved of a great part of their own weight, which, in chains of uniform thickness, without serving any useful purpose, act solely as a dead weight, collected at the middle of the curve, and tending in itself to break down the structure, without the super-addition of any load *in transitu*. One advantage of this new arrangement, no less obvious than it is important, is a material reduction of the amount of iron necessary, and consequently of its expense. But the removal of this dead weight also virtually increases the strength of the bridge, by allowing it, in lieu of that, to sustain without fracture a much greater passing load than the uniform chains can bear. This may be tested in an analogous case, by first ascertaining what weight a piece of wood of uniform thickness, supported at one end on the edge of a table, can bear at the other without being overbalanced, and afterwards what additional weight is necessary to overbalance it when reduced to the form of a wedge. Again, by getting rid of this dead weight, the curve assumed by the chains, being flatter than the catenary, admits of a diminution in the height of the towers, and a corresponding reduction of their expense. Moreover, the chains are thus rendered less liable to swing when acted on by a strong wind, or, if affected at all, they oscillate to a very small extent, and with much less force than the uniform chains. By a comparison of the facility and force with which the slack rope swings when loaded with the dancer, with its slight tendency to do so when unloaded, the truth of this remark will be more readily perceived.

II. In order fully to appreciate the advantage of using oblique suspending rods, (*i. e.*, such as dip more and more as they recede from the towers to the centre of the bridge and in that direction,) it must be remembered, that malleable iron is strongest in resisting a pull in the direction of its length, and weakest in resisting a cross strain. Now, by thus inclining the rods, their direction is gradually assimilated to that of the chains. Indeed, we may consider the chains as forming, in connexion with each successive rod, the hypothenuse of a right angled triangle, the legs of which are formed by the tower and the intervening roadway; for, in Mr. Dredge's bridges, the roadway performs an important part in sustaining the bridge, by acting with a horizontal thrust on the towers. Hence it follows that although the chains and roadway were cut through at the middle of the curve, the security of the structure would not in the least be endangered, because in reality it is formed of two triangles, supported independently of one another, each on its own tower as base, by the tension of the chain and horizontal thrust of the roadway. The consequent rigidity of the whole structure contributes materially to diminish, if not entirely to neutralize, its tendency to vibrate. In the old system of suspension bridges, on the contrary, the roadway, instead of assisting to support the bridge, acts solely as an additional load, im-

parted to chains already overloaded, and imparted to them in the very way in which they are least able to bear it, viz., by vertical rods, which acts on them directly as a cross strain.

Indeed, one could hardly imagine a structure more self-destructive, or better adapted for wasting alike power, material, and money, than the whole plan of suspension bridges—the defects of which the unfortunate Menai Bridge too plainly evinces.

It is superfluous for me to mention, that a beautiful specimen of Mr. Dredge's bridges may be seen spanning the Leven, at Balloch, which, along with the Victoria Bridge, at Bath, one at Wraysbury, near Windsor, and five in Regent's Park, London, may be instanced to attest the merits of the invention; and I cannot entertain a doubt that Glasgow, which owes so much of its prosperity to the light which science has thrown upon its arts and manufactures, will speedily avail itself of improvements in its bridges, at once so beneficial and economical.

I am, Sir, your most obedient servant,
WILLIAM THOMPSON.

Barony Place, 29th March, 1844.

Mr. Dredge to Mr. Thompson.

Bath, 15th April, 1844.

SIR,—I beg to thank you for the great interest and trouble you have taken, in bringing before the citizens of Glasgow my improvements in the construction of Suspension Bridges; and it is the more gratifying to me that you understand the principle so well, and were so clear in your explanation of it in the *Glasgow Constitutional.* But it is not to suspension bridges alone that this principle applies, but to Stone and Cast-iron Compression Bridges too; for there is no real difference in their principles, excepting that one rests upon the arch and depends upon thrust against the key-stone or apex, whilst the other is hung with vertical rods to the inverted arch of chains, and consequently is sustained by tension at the lowest point of the curve. At the same time, instead of the apex of the one arch, or the lowest point of the other, being the grand support of either structure, it ought to be but the points of two projecting arms or brackets, whence weight and power should commence, and progressively increase to each base.

It is true, as you observe, that the roadway on this plan performs a very important part in sustaining a bridge; but there is no thrust against the abutments, unless it be cut in two, for one half of it counteracts the other, and thereby it is resolved into direct tension, the very strongest position in which iron can be placed.

The extraordinary mechanical defect in suspension bridges that you have so happily explained, is universal in bridge engineering.

To instance it more plainly, I need only take the suspended weight of the Menai bridge to be 1000 tons, its versed sine being 1-15th of the chord, the tension at the centre must be nearly 3750 tons, half of it acting in each direction; but instead of which, as I have before stated, this point ought to be but the commencement of weight, and consequently the beginning of tension, or only cipher, as Lord Western very correctly termed it. In a compression bridge of like magnitude and weight, the 3750 tons of tension would be central pressure to the same extent; in fact, a superfluous load, the most fatal element of self-destruction imaginable. To demonstrate it in your own way: take a balanced parallel projecting arm of 1000 tons weight, 7½ times longer than its depth, its tendency to break at the fulcrum would be 3¾ its own weight; wedge-shape the arm—that is, take from it its non-supporting and self-destructive load, it would increase its strength 2500 tons, and save half of the material.

This astounding defect in the construction of bridges is the great cause, though other reasons are assigned, of their immense destruction; yet, notwithstanding, many may endure for centuries, provided their spans be trivial, and the material good.

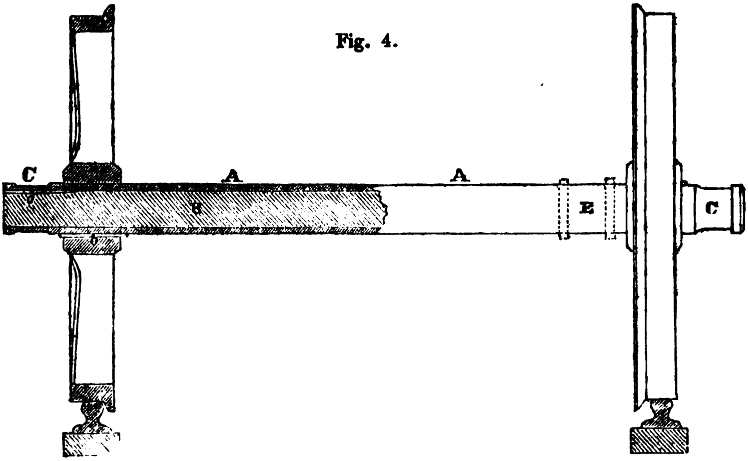
Indeed, you may well observe, "one could hardly imagine a structure more self-destructive, or better adapted for wasting alike power, material, and money, than the old plan of suspension bridges;" but the common plan of cast-iron compression bridges is extravagantly more so, as iron is incalculably stronger on tension than in any other position. The longest iron compression arch known is 240 feet, and the longest suspension arch is 860 feet, but the latter may be extended safely to 5000 feet.

It is worthy of remark that, independently of the great saving of material, time, and, consequently, of money, this plan accomplishes, it overcomes another great engineering difficulty in the construction of bridges; namely, this—Their foundations have been generally most expensive and difficult to obtain, because, having to sustain an enormous horizontal thrust, in addition to their own prodigious weight, nothing but the firmest stratum, or a most expensive artificial footing, could withstand it; but on this plan the most ordinary foundation will suffice for the abutments. The principle having relieved them of all horizontal force, and more than nine-tenths of the weight, and as length of span is but of little consequence, they can be founded wherever it is most convenient to place them.

BRIGGS'S PATENT IMPROVEMENTS IN AXLES.

[Patentee, John George Briggs, of Leicester, coach proprietor. Patent dated October 5, 1843; Specification enrolled April 5, 1844.]

Fig. 4.



Fi . 2.

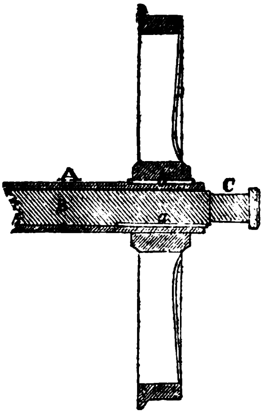
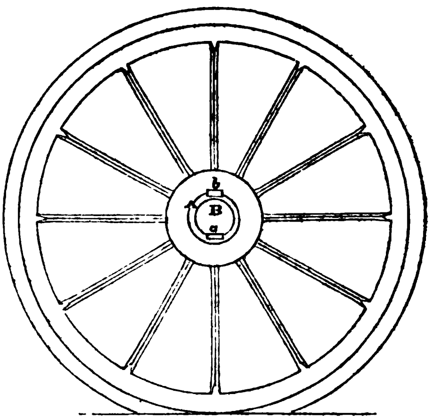


Fig. 3.



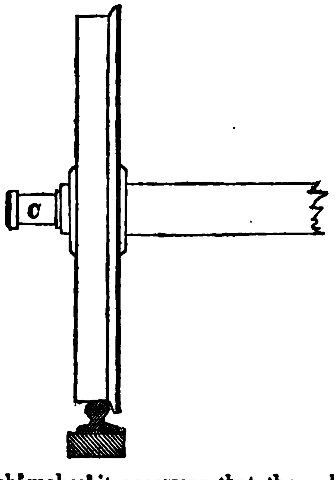
The improvements which form the subject of this patent may be described generally, as consisting in forming the axles of railway and other carriages, of two pieces or shafts, one solid and the other hollow, the former fitting within the other. The inventor calculates that by means of this construction, greater strength and less risk of breakage will be obtained with the same quantity of metal, than when an axle consists wholly of a single or hollow shaft.

Fig. 1 of the prefixed engravings exhibits a pair of railway carriage wheels on this plan. Fig. 2 is a section of one of these wheels together with a portion of the axle; and fig. 3 is a side elevation of the same. A is the external or hollow axle, which is of sufficient length to pass through the eye of both wheels. B is the internal or solid axle upon which the bearings or journals C C are formed; this axle is of such a diameter, that it may, as near as possible, fill the bore of the axle A when passed through the same; and when put in its proper place, it is to be securely fixed with keys or wedges, *a a*, fitting into corresponding

grooves formed in both shafts in the manner represented in figures 1, 2 and 3, or by having a groove cut in the hollow shaft, and a flat upon the solid, or by screws or any other suitable means. The wheels being placed upon the axle A at the proper gauge, are to be securely fixed there by keys, *b b*, or otherwise; also having proper key-seats prepared for them both on the axle and in the eye of the wheel. By this arrangement the internal axle may be removed from its place without disturbing the external one, when it is found necessary to do so by simply removing the keys or wedges, *a a*.

Fig. 4 is an elevation, partly in section, of another railway wheel mounted upon a shaft constructed on the same general principle as the preceding; with this difference, that the external, or hollow shaft, is continued out the whole length,

Fig. 1.



which makes it necessary that the substance of it should be cut into, so as to form the bearings or journals C C; the axles are keyed to each other and to the ieels in the same manner as in fig. 1.

In both the axles before described, the :arings fall upon the outside of the heel, and, therefore, the bearings may e either formed in the internal or exter-al axle; but in all cases where the bear-gs fall between the wheels, the external :le must be cut into, so as to form the urnal for the same; otherwise ruffs or ollars must be welded thereto, as repre-nted by the dotted lines at E upon the xle in fig. 4.

ATMOSPHERIC ENGINES AND THE "SAPPHIRE."

Sir,—Agreeably to the request of "A Steamboat Proprietor," I proceed to make some further remarks upon the merits of atmospheric engines.

It was certainly my intention to attribute the speed of the *Sapphire*, in a great measure, to the nature of her engines; for they have not, like vibrating engines, moving cylinders, working in steam-tight joints, and making it necessary for the steam to pass through complicated passages, in order to enter or leave the cylinder—nor like Gorgon engines, a short stroke and connecting rod, only applicable to very large vessels—nor like steeple engines, a heavy weight, moving up and down above the deck, and rendering the motion extremely irregular and unpleasant.

I think a second perusal of my former letter would show that I alluded to her low pressure, as unfavourable to speed, but as tending to give a feeling of greater confidence to the passengers. It is now generally allowed that high-pressure steam will produce an increase of velocity, and be, at the same time, more economical than low-pressure steam; but the prejudice against it is very general, and not altogether without foundation; for although a boiler is capable of being constructed so as to stand a high as well as low pressure with safety, yet, if the pressure be high, any error in the construction or management is more likely to be attended with serious consequences. It is, however, a mere question between caution and interest; and in all probability the latter will, in the end, prevail.

But to return to the main subject. Atmospheric are larger than double-acting engines in the cylinders, though it does not follow that that part is heavier in consequence.

The steam acting on one side of the piston only, does away with the cylinder-cover, the piston-rod, and the long valve and casings which usually connect the upper and lower passages; while a small increase of diameter is sufficient to double the surface for the steam to act upon, as it is in proportion to the square of that dimension. The boiler, condenser, and air pumps, do not require to be different from what they would be with any other engines. The frame-work has merely to be brought from the top of the cylinders, which are directly under the shaft, and mutually support each other, instead of from the floor; and, independently of this, it may be made lighter, on account of the great uniformity of motion produced by the use of three cylinders.

The use of atmospheric engines has no connexion with economy of fuel. The

small consumption in Watt's engines depended upon the method of condensing, not upon the use of a cylinder cover.

The point which appears to me most unfavourable to this engine is the increase of friction, which must be occasioned by the increased size of the cylinders.

I am, Sir, yours, &c. CURVE.

PROBLEMS ON STEAM POWER. BY MR. THOMAS TATE, MATHEMATICAL MASTER OF THE NORMAL SCHOOL, BATTERSEA.

[Continued from page 184.]

18.—To determine the modification which the preceding expressions undergo, when the engine is single-acting.

1. In the downward stroke the units of work performed upon the counter-weight, C, must be taken as a portion of the useless work done by the engine; hence, we have, by 10, eq. D, putting F + C for F, the useful work upon 1 inch of the piston in one stroke =

$$\frac{U-(F+C)\,(H+h-c)}{1+f} \dots (E).$$

The useful load will be found from this equation, by dividing by the length of the effective part of the stroke.

2. During the upward stroke, let the equilibrium valve be closed at l_{I}, part of the stroke, P_{I}, being the corresponding pressure of the steam; after this point let l_{II} be any other position of the piston, P_{II} the corresponding pressure of the steam above the piston, and p_{II} the corresponding pressure below it; put, also, l for the whole length of the cylinder, including the clearance at the top, as well as at the bottom of the cylinder, then (page 102),

$$P_1 = \frac{1}{\frac{l}{h}\left(\frac{1}{P}+\cdot 00268\right)-\cdot 00268};$$

which will be the pressure of the steam, as well above as below the piston, at the moment the equilibrium valve is closed.

The remaining part of the stroke, $l-(l_{I}+c)$, being now divided into an even number of parts, we proceed to determine the effective pressures of the steam at those respective parts, and so on to the determination of the units of work, U^1, performed against the piston in its ascent. This being premised we have the following relation. The work in raising the counter-weight = the work of friction + the work of the steam. Or,

$$C\,(H+h-c)=F_1\,(H+h-c)+U^1 \dots (Qr),$$

where F_1 is put for the friction upon each square inch of the piston in its ascent, which must be determined by experiment, for this particular class of engines.

The pressures at the different intervals, will be determined, with a sufficient degree of accuracy, by Marriotte's law; for this purpose, we have, in general,

$$P_{\prime\prime} = \frac{l-l_\prime}{l-l_{\prime\prime}} \times P;\ \text{and}\ p_{\prime\prime} = \frac{l_\prime}{l_{\prime\prime}} \times P.$$

$$\therefore \text{ The effective pressure, } P_{\prime\prime}-p_{\prime\prime}=\frac{l-l_\prime}{l-l_{\prime\prime}}\times P-\frac{l_\prime}{l_{\prime\prime}}\times P=\frac{(l_{\prime\prime}-l_\prime)\,l\,P}{(l-l_{\prime\prime})\,l_{\prime\prime}} \dots (I).$$

3. The steam expended in each stroke will occupy that part of the cylinder which is beneath the equilibrium valve the moment it is closed: hence it is obvious, that the steam expended in one stroke, in the place of being h part of the cylinder, as in the double-acting engine, will be $\frac{l_I}{l}\times h$. The number of strokes, therefore, performed in a minute, will be obtained from the relation given in 17, by simply substituting $\frac{l_I}{l}\times h$ for h; and so on to the other incognita, or elements which may be required in the problem.

Example 17. In a single-acting Cornish engine, the length of the cylinder = 12 feet, the steam is cut off at 2 feet, the clearance = 1 foot, the pressure of the steam when admitted into the cylinder = 50 lbs., the friction in an upward stroke = 3 lbs.; required the counter-weight, supposing the equilibrium valve to be closed at the instant the piston is 9 feet from the bottom of the cylinder. Here by 18, 2, the pressure of the steam before the equilibrium valve is closed

$$= \frac{1}{\frac{12}{2}\left(\frac{1}{50}+\cdot 00268\right)-\cdot 00268} = 7\cdot 5 \text{ lbs.}$$

The space over which the steam impedes

the ascent of the piston = 2 feet. Let this space be divided into four equal parts, then the effective pressures, determined by eq. I, at these intervals will be, 0, 2, 4·5, 8·6, and 16·4 respectively, hence by 2, p. 101,

$$U^1 = \tfrac{1}{3} \text{ of } \tfrac{2}{4} \left\{0 + 16{\cdot}4 + 4\,(2 + 8{\cdot}6) + 2 \times 4{\cdot}5\right\} - 11{\cdot}2. \text{ Then by eq. (Qr),}$$

$$C \times 10 = 3 \times 10 + 11{\cdot}2\,;\ \text{or } C = 4{\cdot}12$$

feet.

Observation. — Should the counterweight, thus determined, be found too much or too little, in order to produce the most desirable effect, then the equilibrium valve must be closed at an earlier, or later part of the stroke, as the case may be, and the whole calculation must be gone over again with this new datum.

Example 18. Let the area of the piston, in the last example = 5000 inches, the pressure of the vapour in the condenser = 4 lbs., the friction of the unloaded piston = ·5 lbs. per square inch, the additional friction = $\frac{1}{7}$ of the useful load, and the effective evaporation of the boiler = ·5 cubic feet of water per minute; required the useful work upon 1 inch of the piston in one stroke, the useful load, the number of strokes performed per minute, and the useful horse powers of the engine.

Here, in a downward stroke, the steam acts expansively over a space of 9 feet; let this space be divided into six equal parts, then the distance between each ordinate = $1\frac{1}{2}$ feet, and the pressures calculated by the formula

$$P_1 = \frac{1}{\frac{h_1}{h}\left(\frac{1}{P} + {\cdot}00268\right) - {\cdot}00268},$$

will be $P_1 = 27$, $P_2 = 18{\cdot}5$, $P_3 = 14{\cdot}08$, $P_4 = 11{\cdot}3$, $P_5 = 9{\cdot}5$, $P_6 = 8{\cdot}2$, P being 50. Hence by (2) U = 160 + 50 − 40 = 170.

By eq. (E), 18,

The useful work upon 1 inch of the piston in one stroke

$$= \frac{170 - ({\cdot}5 + 4{\cdot}12)\,10}{1 + \frac{1}{7}} = 108{\cdot}3$$

$$\therefore \text{ The useful load} = \frac{108{\cdot}3}{10} = 10{\cdot}83.$$

[T]he steam expended in one stroke = $\frac{9}{12}$ of the steam admitted at the down[ward] stroke $= \frac{9}{12} \times \frac{2 \times 5000}{144} = 52{\cdot}08$ cu[bi]c feet.

[B]ut the volume of the steam evapora[te]d per minute, at the given pressure 50 [l]bs. $= {\cdot}5\left(\frac{24250}{50} + 65\right) = 275$ cubic feet. The volume of the steam here found may also be derived from experimental tables.

∴ The number of downward strokes per minute $= \frac{275}{52{\cdot}08} = 5{\cdot}28$.

The same result may be immediately obtained from the formula N

$$= \frac{144\,S\left(\frac{n}{P} + m\right)}{K \times \frac{h\,l_1}{l}}\,;$$ see 18, 3.

The useful h. p.

$$= \frac{5000 \times 108{\cdot}3 \times 5{\cdot}28}{33{,}000} = 86{\cdot}6.$$

19. To find the relation between the horse powers of an engine, and the elements of the labour which it has to perform.

Let the engine pump water from a mine, which makes Q cubic feet of water per hour, and whose depth is D fathoms; then,

The depth of the mine = 6 × D feet.

The weight of the water pumped per minute $= \frac{Q \times 62{\cdot}5}{60}$.

The units of work in pumping the water per minute = depth of the mine in feet × weight of the water in lbs. pumped per minute

$$= \frac{6 \times D \times Q \times 62{\cdot}5}{60} = 6{\cdot}25 \times D\,Q$$

$$\therefore \text{ H. P.} = \frac{6{\cdot}25 \times D\,Q}{33{,}000} = \frac{D\,Q}{5280} \quad \text{(O)}$$

Example 19. What must be the useful horse powers of an engine, in order to pump 400 cubic feet of water per hour, from a mine whose depth is 200 fathoms?

Here the depth of the mine = 6 × 200 feet.

Weight of the water pumped per minute $= \frac{400 \times 62{\cdot}5}{60}$.

Units of work required in pumping the water per minute

$$= 6 \times 200 \times \frac{400 \times 62{\cdot}5}{60}$$

In a double stroke of the piston, the driving wheel performs one revolution, that is, the train is advanced a space $= 5 \times 3{\cdot}1416$ feet. But the engine performs $\frac{186{\cdot}5}{2}$ double strokes per minute,

$\therefore$ the velocity of the train per minute $= \frac{186{\cdot}5}{2} \times 5 \times 3{\cdot}1416$ feet; or, the velocity per hour $= \frac{186{\cdot}5 \times 5 \times 3{\cdot}1416 \times 60}{2 \times 5280} = 16{\cdot}6$ miles. Now the value of g was estimated, by assuming the velocity to be 17 miles per hour; as a nearer approximation to the correct value of this resistance, we have, $g = 1{\cdot}75 \times \frac{16{\cdot}6}{10} = 2{\cdot}9$.

Introducing this new value of g, we find $P = 50{\cdot}9$, and going over the whole process, as just explained, the number of strokes per minute $= 187{\cdot}1$; and the velocity per hour $= 16{\cdot}7$ miles nearly.

(*To be continued.*)

NEW DUTIES ON THE IMPORTATION OF STEAM ENGINES INTO FRANCE.

A projet de loi has just been presented to the Chamber of Deputies by the Minister of Commerce, relative to the duties imposed on the admission of machinery and steam-engines into France—a subject which will, no doubt, excite considerable interest both at home and abroad. It will be remembered that up to 1837, the duty upon the admission of machinery into France was 15 per cent., and upon *steam-engines*, 30 per cent.; and the costs were also heavy, but, by a royal ordonnance of the 15th March, 1837, steam-engines were admitted as machinery at 15 per cent. duty.

It is stated that, in 1843, there were in France, on the different railways, 238 locomotive engines, 115 of which only were built in France, and 119 were the manufacture of other countries—but the greater part of these machines were *ordered before* the reduction of the duty. Since the reduction, we are informed, that *almost all* are supplied by England.

The duty hitherto has been *ad valorem*, but it is now proposed to levy an import duty on the *weight of the engine and tender*, which will, in fact, exceed the old protective duty of 30 per cent. The new duty proposed is 65 f. 54 c. per 100 kilogrammes, which, on a locomotive of 14 tons, would amount to 9,100 f., or 379*l.* 3*s.* 4*d.*; and on the tender, of 5½ tons, to 2,475 f., or 103*l.* 2*s.* 6*d.*; in all, 11,575 f., or 482*l.* 5*s.* 10*d.* Now a locomotive of this weight, with its tender, is worth in France about 40,000 f., or 1,671*l.*: with 30 f. duty, *ad valorem*, it would have paid 12,000 f., or 480*l.* odd, a sum very nearly equal to the sum proposed to be levied by the new Act. This is part of the reciprocity system! No sooner is machinery set free at home, than France imposes protection duties. When convenient to the machine-makers of the Continent, the 15 per cent. will probably be increased.—*Railway Record.*

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65. FROM 29TH MARCH TO APRIL 19TH, 1844.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
Mar. 29	156	John Twist	Bridgetown, Stratford-on-Avon	Design for cultivator or skim plough.
30	157	Jacob Hankins	Farningham, Kent	Spiral propelling motion for carriages, boats, &c.
,,	158	W. Allen	Lamb Inn, Batheaston, Somerst.	Washing crimp
,,	159	W. Hill	12, Tottenham-court, New-road.	A ventilator for buildings.
April 1	160	Timothy Smith and Sons.	Bartholomew-street, Birmingham	Smiths' lock-table fastener.
,,	161	John Vernon and Co.	The Dee Iron Works, Aberdeen.	A tilt hammer.
,,	162	A. Mullar and Co	43 and 44, Princes-street, Edinburgh	Cravat fastener.
,,	163	Hiram Groves	45, Henry-street, Dublin	A bellows for the melodian and other musical instruments.
4	164	George Morton	Dale-street, Liverpool	Design of a new construction for bodies of vehicles.
12	165	John Wallis Allen	Weymouth	Pneumatic chimney top or cowl.
15	166	John Weems	Johnstone, Renfrewshire	Improved ash-pan for fire-grates.
,,	167	Thomas Pritty and Henry Rayner Hodgson	Bury St. Edmonds, Suffolk	Euston plough.
18	168	John Bourn	31, Lionel-street, Birmingham	Bourn's nonpareil sash fastener.
19	169	A. Berni and Melliard	56 and 57, Great Guildford-street, Southwark	A new design for the configuration of a hat ventilator.

NEW WORKS CONNECTED WITH THE ARTS AND SCIENCES PUBLISHED IN APRIL.

Two Lectures on Machinery, delivered before the University of Oxford, in Lent Term, 1844, by Travers Twiss, D.C.L., F.R.S., Professor of Political Economy, and Fellow of University College. 2s.

Original Diaper Designs, for the Use of Decorative Painters, Carpet, Damask, and Shawl Weavers, Calico Printers, Stained Glass Manufacturers, &c.; with an Essay on Ornamental Design. By D. R. Hay, Author of "Laws of Harmonious Colouring," &c. Part I. 3s. 6d.

The Rule of Three: not the Rule of Proportion, but a Rule illustrating Proportion, and a Method of Solution proposed, which does not require the use of Proportion. With numerous examples. By the Rev. J. Cotterill. 3s.

The Elements of the Differential and Integral Calculus; with numerous Examples and Familiar Explanations, designed for the use of Schools and Private Students. By James Connell, Master of the Mathematical Department in the High School of Glasgow. 8vo. 9s.

Caloric: its Mechanical, Chemical, and Vital Agencies in the Phenomena of Nature. By Samuel L. Metcalfe, M.D., of Transylvania University. 2 vols. 8vo. 1*l* 15s.

An Encyclopædia of Domestic Economy, comprising such subjects as are most immediately connected with Housekeeping, as Building, Furnishing, Servants, Cookery, Dress, Carriages, Health, &c. By Thomas Webster, F.G.S., &c., assisted by the late Mrs. Parkes, author of "Domestic Duties." One thick volume, 8vo., with nearly 1000 woodcuts.

Sopwith's Geological Models.

These models are constructed of various kinds of wood fitted together from actual measurements of the strata in the coal and lead mining districts of the North of England. The upper part of each model represents the surface of the ground,—the sides exhibit four vertical sections, each of which corresponds with the sections usually drawn in geological works, and the base of each model represents a horizontal plane at a certain depth under the surface, according to the scale of the model. The models illustrate the Nature of Stratification; of Valleys of Denudation; Succession of Coal Seams in the Newcastle Coal Field; Strata of adjacent Lead Mine Districts; the effects produced by Faults or Dislocations; Intersections of Mineral Veins, &c.: and are accompanied with a letter-press description. By T. Sopwith, Esq., F.G.S., Memb. Inst. C. E., Author of a Treatise on Isometrical Drawing, &c. Sold in cases, bound and lettered to resemble large octavo, quarto, or folio volumes. From 2*l*. to 5*l*. A Description of the models is published separately, 1s. 6d.

Parnell's Applied Chemistry in Manufactures, Arts, and Domestic Economy. Part 7. Manufacture of Glass and Starch. 2s.

Periodicals.

The Phytologist; a Popular Botanical Journal, on the plan of "The Zoologist." No. XXXV.

The Zoologist; a Popular (Monthly) Journal for recording (after the manner of the Rev. Gilbert White, of Selborne) original observations relating to the instincts, habits, food, retreats, migrations, nests and young of animals.

The Archæological Journal. Published under [th]e direction of the Central Committee of the Bri[tis]h Archæological Association for the Encourage[m]ent and Prosecution of Researches into the Arts [an]d Monuments of the Early and Middle Ages. No. to be continued quarterly. 2s. 6d.

Contents:—An Introduction, by Albert Way, [E]sq.—On Numismatics, by C. R. S.—On Painted [G]lass, by C. W.—On Anglo-Saxon Architecture, by [T]. Wright, Esq.—On Bell-Turrets, by the Rev. J. . Petit—On the Medieval Antiquities of Anglesey, [b]y the Rev. H. L. Jones—On the Horn-shaped [La]dies' Head-dress in the reign of Edward I., by T. [W]right, Esq.—On Cross-legged Effigies commonly appropriated to Templars, by W. S. W.—Catalogue of the Emblems of Saints, by the Rev. C. Hart—Original Documents: Early English Receipts for Painting, Gilding, &c.—Proceedings of the Central Committee of the British Archæological Association—Notices of New Publications.

The London, Edinburgh, and Dublin Philosophical Magazine. No. 156. 2s. 6d.

The Edinburgh New Philosophical Journal. No. 74. 7s. 6d.

The Civil Engineer and Architect's Journal. No. 80. 1s. 6d.

The London Journal (Newton's). No. 148. 2s. 6d.

The Repertory of Patent Inventions. Enlarged Series. No. 18. 3s.

The Glasgow Practical Mechanics' and Engineers' Magazine. Part 31. 8d.

The Artizan. No. XV. 1s.

The Builder. Part XIII. 8d.

Annals of Chemistry and Practical Chemistry. No. 29.

The Nautical Magazine. No. 15. Enlarged Series. 1s.

Pharmaceutical Journal and Transactions (Bell). 1s.

The London Polytechnic Magazine. Edited by Thomas Stone, M.D. No. 4.

Annals and Magazine of Natural History, including Zoology, Botany, and Geology. By Sir William Jardine, Bart., P. J. Selby, Esq., Dr. Johnson, &c. No. 134. 2s. 6d.

Chemical Gazette, or Journal of Practical Chemistry in all its Applications to Pharmacy, Arts, and Manufactures. By William Francis. 2s.

LIST OF ENGLISH PATENTS GRANTED BETWEEN 30TH OF MARCH, AND THE 24TH OF APRIL, 1844.

John Robert Dicksee, of Old Compton-street, Soho-square, artist, for improvements in the manufacture of mosaics. March 30; six months.

William Crosskill, of the Iron Works, Beverley, for improvements in machinery for making wheels for carriages. March 30; six months.

Henry Clayton, of Upper Park-place, Dorset-square, Regent's-park, plumber and machinist, for improvements in the manufacture of tiles, drain pipes, or tubes and bricks. March 30; six months.

John Biggs, of the borough of Leicester, manufacturer, and Richard Harris, the younger, of Leicester, aforesaid, manufacturer, for improvements in the manufacture of looped, woven, and elastic fabrics. March 30; six months.

Leonard Bostwick, of Fen-court, Fenchurch-street, London, merchant, for certain improvements in machinery or apparatus for sewing all kinds of cloth or other materials. April 2; six months.

William Stace, of Berwick, Sussex, farmer, and Philip Vallance, of the same place, farmer, for improvements in applying power for drawing or working ploughs and other implements and carriages used for agricultural purposes. April 2; six months.

John Parsons, of Selwood-terrace, Brompton, gent., for certain improvements in machinery or apparatus for cleansing or sweeping chimneys and flues. April 2; six months.

James Murdoch, of Staple's-Inn, London, mechanical draughtsman, for certain improved apparatus and processes for preparing the Phormium tenax, or new Zealand flax, so as to render it applicable to various useful purposes. (Being a communication.) April 2; six months.

Frederick Brown, of Luton, Bedford, ironmonger, for improvements in stoves. April 10; six months.

James Murray, of Garnkirk Coal Company, Scotland, for a new method of using and applying artificial gas made from coal, oil, or other substances, for lighting and ventilating caverns, pits, or mines, or other pits where minerals or metals are worked or extracted. April 10; four months.

Richard Barber, of Hotel-street, Leicester, con-

fectioner, for improvements in apparatus for giving quick rotary motion to mops and such like instruments. April 10; six months.

John Aitken, of Surrey-square, for improvements in water machines, or engines and steam-engines, and the mode of traction on, or in canals or other waters or ways. April 10; six months.

George William Lenox, and John Jones, of Billiter-square, London, merchants, for improvements in the manufacture of sheaves and shells for blocks, and of bolt rings or washers, for the purposes of shipwrights and engineers. April 10; six months.

James Kennedy, of the firm of Bury, Curtis, and Kennedy, of Liverpool, engineer, and Thomas Vernon, of the same place, iron ship-builder, for certain improvements in the building or construction of iron and other vessels for navigation on water. April 15; six months.

John Lawson, of Leeds, engineer, and Thomas Robinson, of the same place, flax-dresser, for certain improvements in machinery for heckling, dressing, combing, and cleaning flax, wool, silk, and other fibrous substances. April 16; six months.

Edgar Heale, of Brixton, gent., for certain improvements in the construction of carriages for the conveyance of passengers on roads and railways April 18; six months.

Donald Grant, of Greenwich, esq., for improvements applicable to the ventilation of apartments in which gas and other combustible matters are consumed by ignition. April 18; six months.

John Bailey Denton, of Gray's Inn-square, land-agent, for improvements in machinery for moulding or shaping clay and other plastic substances, for draining and other purposes. April 18; six months.

James Murdoch, of Staple's Inn, mechanical draughtsman and civil engineer, for certain improvements in the construction of vessels for holding aërated liquids, and in the means for introducing such liquids into the said vessels, and retaining them therein. (Being a communication.) April 18; six months.

John Smith, of Bradford, York, worsted spinner, for improvements in machinery for tentering and stretching cloths or fabrics. April 18; six months.

Richard Roberts, of the Globe Works, Manchester, engineer, for certain improvements in machinery or apparatus, for the preparation of cotton and wool, and also for spinning and doubling cotton, silk, wool, and other fibrous substances. April 18; six months.

Joseph Woods, of Barge Yard Chambers, Bucklersbury, gent., for improvements in regulating the power and velocity of machines for communicating power. (A communication.) April 18; six months.

William Hodson, of New King-street, Kingston-upon-Hull, estate agent, for a machine for making and compressing bricks, tiles, square pavers, and ornamental bricks. April 18; six months.

Henry Frearson, of Arno Vale, Nottingham, lace manufacturer, for improvements in the manufacture of warp fabrics. April 23; six months.

Peter Lear, of Boston, Suffolk, of the State of Massachusetts, America, gent., for certain new and useful improvements in machinery for propelling vessels through the water. April 23; six months.

William Taylor, of Birmingham, door spring manufacturer, for improvements in the manufacture of axle pulleys, and in pegs or pins for hanging hats or other garments. April 24; six months.

René Allaire, of Charlotte-street, Fitzroy-square, dyer and cleaner, for improvements in cleansing gentlemen's garments. April 24; six months.

LIST OF PATENTS GRANTED FOR SCOTLAND FROM MARCH 26TH, TO APRIL 17, 1844.

William Ritter, of 106, Fenchurch-street, London, for improvements in crystallizing and purifying sugar. (Being a communication from abroad.) Sealed, March 26.

Charles Harrison, manager of the Coel Talon and Leeswood Iron Works, Flintshire, for certain improvements in the manufacture of cast-iron pipes and other castings. March 26.

William Isaac Cookson, of Newcastle-upon-Tyne, for improvements in apparatus for burning sulphur in the manufacture of sulphuric acid. March 26.

Elisha Haydon Collier, Esq., of Goldsworthy, Terrace, Rotherhithe, Surrey, civil engineer, for certain improvements in the construction of furnaces and flues. March 27.

Joseph Dickinson Stagg, of Middleton, in Teesdale, Durham, Manager of Smelting Works, for a new and improved plan for collecting, condensing, and purifying the fumes of lead, copper, and other ores and metals, also the particles of such ores and metals arising, or produced from the roasting, smelting, or manufacturing thereof, and also the noxious smoke, gases, salts, and acids, soluble and absorbable in water generated in treating and working such ores and metals. March 30.

William Edward Newton, 66, Chancery-lane, Middlesex, civil engineer, for an improvement or improvements in furnaces. (Being a communication from abroad.) April 4.

John Stevelly, of Belfast, Ireland, professor of natural philosophy, for improvements in steam-engines. April 10.

Thomas Nash, of Paul's Cray, Kent, paper maker, and Francis Pirie, of Watling-street, London, paper maker, for certain improvements in the manufacture of paper, and in the machinery to be used therein. April 11.

William Thomas, of Cheapside, London, merchant, for improvements in fastenings for wearing apparel, and which may also be applied as fastenings to portmanteaus, bags, boxes, books, and other things. (Being a communication from abroad.) April 15.

John Lawson, of Leeds, York, engineer, and Thomas Robinson, of the same place, flax-dresser, for certain improvements in machinery for heckling, dressing, combing, and cleansing flax, wool, silk, and other fibrous substances. April 17.

NOTES AND NOTICES.

The Manchester Gas-works are the most splendid and extensive in the kingdom. At the present moment these works contain one million one hundred thousand feet of gasometer space, and the directors have just completed a contract for another gasometer to contain 200,000 feet, which is to be completed next autumn; so that, when this is in operation, the gasometer room will be 1,300,000 cubic feet.

New Application of Screw Power.—Mr. James Liggett has just completed the working model of a machine which is considered by many to be the greatest discovery of the age. It is the application of the power of the screw to wheel machinery, whereby the gain of power is so great that, with a screw weighing from one to one-and-a-half tons, a man would be able to propel a train of cars on a railroad with as much force and velocity as is now attained by the locomotive. It occupies but a small space, and can be applied to any kind of wheel machinery.—*Baltimore Sun.* Wonderful if true; but not true, because impossible.

LONDON: Printed and Published by James Bounsall, at the Mechanics' Magazine Office, No. 166, Fleet-street.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; and W. C. Campbell and Co., Hamburgh.

Mechanics' Magazine,

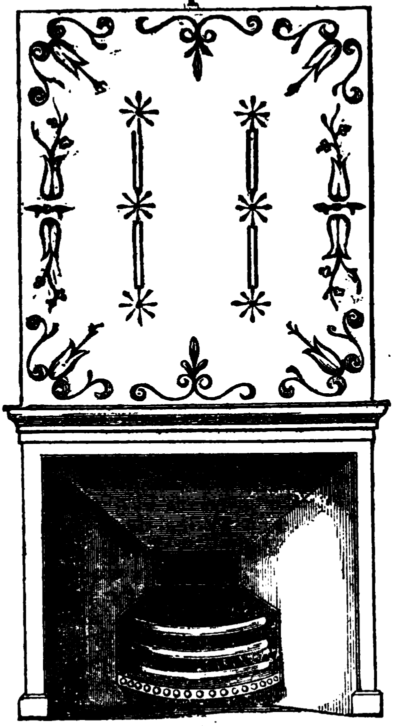
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1082.] SATURDAY, MAY 4, 1844. [Price 3d.

Edited by J. C. Robertson, No. 166, Fleet-street.

OPEN FIRE GRATE WITH INDEPENDENT IRON FLUE.

1



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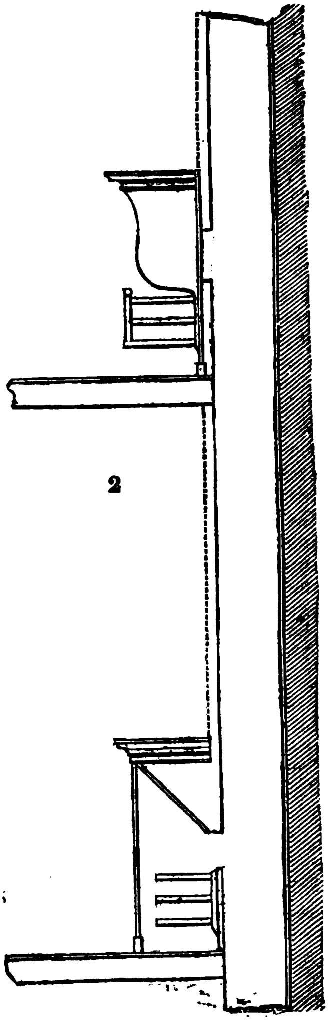

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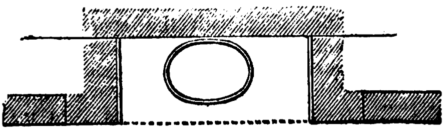

ON THE CONSTRUCTION OF OPEN FIRE-GRATES WITH INDEPENDENT IRON FLUES, ETC.*

Sir,—I am pleased to observe from the extracts you have given from the Transactions of the Society of Arts, in your No. 1067, for January, p. 44, that the subject of fire-places and chimneys as occasionally constructed, has engaged the attention of a person of such great practical knowledge and ability in these matters as Mr. Sylvester; and I hope it may lead to some decided improvement in these necessary and important appendages to our houses, in which, notwithstanding all that has been done by Mr. Sylvester himself and by others, so much room for improvement still exists.

In your Magazine for April, 1843, page 322-3, I ventured some observations of a similar tendency with the plan recommended by Mr. Sylvester; one of the collateral objects I contemplated therein, being to avoid the unpleasant and dirty process of sweeping the chimneys into the fire-flues of the several apartments, by having a single flue or chimney for all the rooms placed immediately above each other, which should be carried up from the basement to the top of the house, with the fire-grate of each room placed in front, and communicating with the flue by an opening in the back of the grate. But I had a more immediate object in view in suggesting this arrangement, which was to render the heated gases escaping by the chimney available in aiding the temperature of the room through which it passes; and for this purpose I suggested having an iron flue or chimney placed in an open recess over the wall, the front of which should be covered by a thin screen perforated with ornamental tracery, and extending from the mantel piece to the ceiling of each room. Without repeating more of what I then wrote, I would again invite attention to the plan, concurrently with the views propounded by Mr. Sylvester, and for this purpose solicit your permission to illustrate it by an engraving or two.

Fig. 1 is a front view of the fire-place, with part of the ornamental screen.

Fig. 2 a side elevation and section of the arrangement as applied to two rooms, one above the other, the length of course being shortened for the convenience of room. Fig. 3 is a horizontal section of the chimney and recess; the dotted lines in both figures representing the screen, which is flush with the wall of the room.

The fire-grate of each room being placed in front of the flue, projects considerably into the apartment, of which advantage may be taken, to increase the direct radiating range of the fire, as is done in Jeffrey's pneumatic grate, by means of two cheeks or side pieces projecting from the back, and placed above, and on each side of the grate, an arrangement which is exhibited in the upper part of fig. 2. In other cases, the jambs or sides of the fire-place must project as far as the front of the grate, as in ordinary fire-places, and represented in fig. 1 and lower part of fig. 2. In either way, we have, besides the heat directly radiated into the room from the fire, that given off at the back of the frame, as well as the heat of the ascending current of smoke given off by the flue, which is taken up by the air of the recess and thence diffused through the open work of the screen into the apartment. Thus, nearly the whole of the heat evolved by the combustion of the fuel would in one way or other be turned to useful account; the upper portion of the flue and the rooms through which it passes, participating also in a lower degree in the warmth of the ascending current.

The arrangement would be rendered more complete by having openings (capable of being closed at pleasure) in the several floorings of the recess from one room to another, and one in the ceiling of the recess of the highest room communicating with the space below the roof of the house. By opening one or more of these communications, the superabundant and inconvenient warmth of a room in which a fire is kept may be transferred with benefit to those above in which there are no fires; and by opening the whole, perfect ventilation of

* The paper which we now publish was received prior to another from the same intelligent correspondent, which appeared in No. 1077, March 30, and should have also preceded it in the order of publication, but, through some oversight the one was substituted for the other. This will explain to the reader the reference made, March 30, to the subject matter of the present, though then unpublished communication.—ED. M. M.

all the apartments may be obtained at pleasure.

I can anticipate that objections will be offered to this plan, and some of them present themselves to my mind; but as none appear to me conclusive against its adoption, I should not do right in occupying more of your pages than briefly to allude to two, which I take to be the chief. 1st, That of expense—the question of expense, for instance in a house of four stories, between building four separate chimneys as at present, and, making a single recess and placing in it an iron flue of the height of the four stories with screens for covering the recess. I do not mean to say the expense will not be greater in the latter case; but merely wish it to be considered, whether the greater expense of first construction, will not be more than counterbalanced by superior advantages in point of permanent comfort, convenience, and economy of the means of producing warmth in a house. 2nd, On account of the size of which it would be necessary to make the flue. The most suitable size in any case could only be ascertained by experiment; but looking at the large fires of an ordinary steam vessel and the dense volume of smoke discharged from their funnels, far exceeding, perhaps, the smoke from all the fires of a house combined, I am inclined to think, taking as before the case of a house of four stories, that a flue, scarcely larger than a common chimney, would be found sufficient.

I am, &c. &c.

N. N. L.

INSTITUTION OF CIVIL ENGINEERS.

MINUTES OF PROCEEDINGS, SESSION, 1844.

13th, 20th, 27th of February.

*Screw Propelling.**

An "Account" by Mr. Grantham was read "of some experiments on a vessel called the *Liverpool Screw*, fitted with Grantham's gines and Woodcroft's screw propeller."

The *Liverpool Screw*, upon which the experiments, described in this paper, were d, is a small iron vessel 65 feet long by 12 feet 6 inches beam, and 3 feet 9 inches draught of water. She is propelled by two high-pressure oscillating engines, with cylinders of 13 inches diameter and 18 inches length of stroke. The steam, which varies from 56 lbs. to 60 lbs. pressure in the boiler, is admitted to the piston for one-fourth the length of the stroke, the remainder working by expansion. The nominal power was 20 horses, but the effective power rarely exceeded 18½ horses. The cylinders are placed diagonally, at right angles to each other, and work to one crank upon the main driving shaft, which runs direct to the propeller without gearing or bands.

The propeller, which makes 95 revolutions per minute, is on Woodcroft's plan, with a pitch expanding from 10 to 11 feet; after being enlarged at three several times, from 3 feet 10 inches diameter, it is now 5 feet 4 inches diameter by 20 inches long; it is of wrought iron, and consists of four short arms, whose united area is equal to 16 square feet; of this, only about 13 feet are immersed, a portion of the upper side being constantly above the water: the angle of the centre of the floats is 45°, and about 40° at the periphery.

The author then gives the details of a number of experiments, and he states that, although the proportions of the vessel were not favourable for speed, her length being only five times the beam, and the sectional displacement 28 feet, the speed was greater than that of all the steamers on the Mersey, except the large sea-going steam-vessels.

That the "slip" of the propeller, when tried by Massey's log, was less than five per cent.

That the action of the screw across the way of the vessel, did not appear to affect the steering, or have the slightest tendency to turn the head of the vessel.

The author is of opinion, that engineers in general, fearing a loss might take place from lateral action, with a long pitch, and that the steering would be affected if the propeller was not immersed, have made the propellers too small, and that the short pitch, which had rendered a high velocity necessary, was detrimental.

Several satisfactory experiments, in towing vessels, are also mentioned, and it is stated that in a heavy sea the superiority of the screw propeller was very visible.

The dimensions are then given for vessels of war and of commerce, working with screw propellers, driven direct by oscillating engines, which the author anticipates would prove much more serviceable and seaworthy, than any of the paddle-wheel steamers now in use.

The paper is illustrated by a diagram, (No.

* Some partial notices of this important discus- have already appeared in our pages (see pre- vol. p. 124,) but the whole of it is so admirably orted in the Minutes of the Institution by its e Secretary, Mr. Manby, that for the sake, as ll of unity of connexion as of greater complete- s, we give this portion of the Minutes entire.— . M.M.

3581) of the propeller of the *Liverpool Screw*, and by plans of the machinery and general arrangements of the proposed frigate and large steamers, Nos. 3572 to 3575.

Mr. Rennie observed, that the Institution was much indebted to Mr. Grantham, for bringing forward the subject of screw-propellers; the more particularly as it had now become of national importance, and that every attempt at perfecting the sub-marine propeller merited encouragement.

It was difficult, correctly to assign the merit of the first invention of this species of propeller, as it had been tried at various periods, and with as varied results, on the Continent, in the United States of America, and in this country;* but it appeared certain that Mr. Samuel Brown, the inventor of the gas vacuum engine, was among the first who applied the sub-marine propeller with any practical effect. The propeller used by him was on the principle of a regular screw, and consisted of two blades, which were affixed at an angle of 45° to a horizontal shaft, which was placed in the bow of the vessel, and he believed that it had also been used in the stern. This propeller was driven by a gas vacuum engine, of the nominal power of 12 horses, and actually caused a vessel of 60 feet in length to move at the rate of six or seven miles per hour.

M. Sauvage, of Boulogne-sur-Mer, had also made several attempts at propelling vessels by the same means, and it was very gratifying to find that his services had recently been acknowledged and rewarded by the King of the French.

It was, however, Mr. F. P. Smith who first rendered the screw-propeller practically useful; for his perseverance, being aided by spirited capitalists, induced the building of the *Archimedes* steamer, the machinery of which was constructed by Messrs. G. and J. Rennie, in the year 1839. The results obtained from that vessel were well known, and caused the subsequent application of the screw to the *Princess Royal*, the *Great Northern*, H. M. S. V. the *Bee*, the *Rattler*, and the *Dwarf*, formerly the *Mermaid*, a model of which was exhibited, with the various forms of screws used in the different experiments. The *Great Britain* not having yet been to sea, could only be mentioned as a projected experiment.

The *Dwarf* was 130 feet in length, 16 feet 6 inches in breadth, 9 feet deep, and was 164 tons burthen. The power of the engines was 90 horses, making from 30 to 32 strokes per minute. Friction wheels without teeth were first tried for giving motion to the propeller; but on account of their slipping and being very noisy, they were abandoned, and two spur mortice-wheels with wooden teeth, working into iron pinions, were substituted; the speed thus attained was from 150 to 160 revolutions per minute. The propeller was of cast-iron, and was moulded in loam without a model, by means of iron templates cut to the required curve, which was formed from a solid cone revolving on its axis, during the perpendicular descent of a tracer. The advantage of this form over the cylindrical screw was an increasing pitch, so formed, that while the propeller was rotating on its axis the vessel was advancing, and thus producing the least possible amount of "slip."*

This was exemplified by the form of the various models on the table.

The principal point to be obtained in a screw propeller was a form which should offer but little obstruction to the water, and yet act upon it so as to exert full power in propulsion; a large portion of a complete screw having no useful effect, had induced the introduction of propellers with several blades; thus doing away with the useless part of the surface. A great portion of the centre part of the screw of the *Archimedes* had been cut away, but the effect had not been so good, on account of the arms of the screw obstructing the free passage of the water; the propellers with three arms were, he believed, preferred to those with a larger number.

The *Dwarf's* propeller consisted of three curved blades, formed on the conoidal principle, by variable curves approximating to angles of from 27° to 30°, and advancing at the rate of 7 feet 6 inches per revolution. It was 5 feet 10 inches in diameter, by 2 feet deep in the direction of its axis, and the

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* The dates of the experiments on screw propellers are nearly in the following order:—

Baron Seguier	1792	Cummerow	1828
Fulton	1796†	Sauvage	1832
Shorter	1802	Woodcroft	1832
Trevithick	1815	Ericsson	1836
Millington	1816	Smith	1836
Lowe	1817	Lowe	1838
Whytock	1819	Hunt	1839
Perkins	1824	Rennie	1839
Brown	1825	Blaxland	1840
Woodcroft	1826	Carpenter	1841‡

† In a letter to Dr. Cartwright, dated Paris, February 16, 1798, Fulton says, "I have just proved an experiment on moving boats, with a fly of four parts, similar to that of a smoke-jack, and I find this apply the power to great advantage, and it is extremely simple."

‡ For some additions to this list see *Mech. Mag.* vol. xxxix., pp. 292, 340, 388.—ED. M. M.

* In a letter to the Chief Secretary of the Admiralty "On Sub-marine Steam Propelling," by G. Steinman, Esq., 1843, the author asserts that the propeller used in the *Dwarf* was *Blaxland's*, the lines of which are produced in quite a different manner from that stated in the text. The truth on this point requires clearing up.—ED. M. M.

area was about 15 square feet, which was nearly one-fourth of the area of the midship section of the vessel at light draught; but since the *Dwarf* had been transferred to H. M. Service, the mean draught had been increased 1 foot, and the area of the midship section in proportion; her speed had in consequence been reduced from 12 to 11 statute miles per hour.

The following were the results of the trials made by Captain Sir Edward Parry, Mr. Lloyd, and Mr. Murray, at the measured mile in Long Reach, on the 15th May, 1843:—

1st	Experiment	against tide..........	9·890	12·145
2nd	ditto	with tide............	14·400	
3rd	ditto	against tide..........	9·756	12·078
4th	ditto	with tide............	14·400	
5th	ditto	against tide..........	9·890	12·203
6th	ditto	with tide............	14·516	
		General Average............		12·142 Stat. miles per hour.

The draft of water was 5 feet 8 inches.

The *Dwarf*, under the command of Lieutenant Nicholls, left Greenhithe, in company with the *Hecate*, Captain Bower, on the 14th January, 1844, and reached Portsmouth on the following day; on the 20th she left Portsmouth, accompanied by the *Hecate*, and although it was necessary to reduce the speed of the engines to 26 revolutions, in order to keep with her consort during the night, they reached Falmouth on the 21st, after an additional run towards the Scilly Islands, making a distance of 200 miles in 23 hours, having burned 10 tons of coals in 27 hours, from the time of getting the steam up. The two steamers left Falmouth on the 23rd, and reached Bear Haven on the following day, having run 135½ knots, or 156 miles by the log, in rough weather in 12 hours, and with bad coal; the engines making from 28 to 29½ revolutions per minute. She anchored during the night at Bear Haven, and on the following day (the 26th) reached Tarbert, the total distance from Falmouth being upwards of 400 miles.

Mr. Galloway said, that it was extremely difficult, if not impracticable, to arrive at the true amount of the "slip" of the propeller, because, from its position abaft, or in what is termed the deadwood of the vessel, it acted in a current which was continually flowing to fill up the cavity, which would otherwise be formed by her progress through the water. The relative motion of a stream through the arches of a bridge, and in the wake of its piers, was an apt illustra-ı of what unquestionably took place (and n the same law) in the case of a moving sel. The screw, therefore, when acting this current, might be compared to what ıld occur, if a paddle-wheel steamer was ›posed to be moving in still water, while floats acted in side canals, which flowed ıe same direction as the vessel. Whether benefits derived from this following cur- giving resistance to the screw, were not unteracted by the deduction of so much of what is termed minus pressure from the ship itself, was not at present under consideration. His object was to show, that an accurate estimate of the amount of "slip" of a screw, could not be arrived at, until the rate of the following current was first ascertained.

That the "slip" must be much greater than Mr. Grantham assumed, would, he thought, be admitted, both from the circumstance he had stated, and from the fact that screw propellers, when worked with the vessels at their moorings, invariably moved at a ratio at least equal to one-half the speed obtained when running. It was clear, therefore, that the "slip," which was dependent on the proportion of the resistance of the screw, compared to that of the vessel, must always exist in a degree; but that it might in the screw be reduced below that of the paddle-wheel was evident, because in the best modifications of wheels, or where the immersed segment was small, the paddle must turn in the water in effecting a change of position from its angle of entrance to that of its emersion, and this unavoidable angular action, even when the upper edge of the float coincided with the rolling circle, was still so much "slip" inevitably encountered; this "slip" too became very considerable when the vessel was in a seaway; but the "slip" of the screw decreased with its magnitude, and in the like proportion its action approached that of a screw moving in a solid. It appeared, therefore, to him, that if the "slip" was small, the spiral or increasing pitch would be a disadvantage, because a true screw would, under those circumstances, create little or no disturbance; while the spiral, in that case, would have the contrary effect, for the same reason tha a helix would pass with facility through a solid, in which a spiral or untrue thread would become fixed, or would move with difficulty. In the absence of all "slip," or in so small a slip as Mr. Grantham assumed to have taken place in his experiments, the effect of

a propeller with an expanding pitch would be like that of a curved plate moving through the water in a right line, while the true helix would have acted like a flat plate moving in the direction of its own plane: that is to say, the opposing forces would merely consist of edge resistance and surface friction, which were common to every kind of propeller.

The advantage, too, which was assumed to arise from this spiral propeller merely affected the question of magnitude, for it was clear that, whether the screw acted upon a large body of water at once, or gave a second impulse to a lesser quantity, the result would be similar as to the sum of the effect upon the vessel. It was true that in certain kinds of fish (he would instance the electrical eel), the impulse produced by the ventral fin was by an increasing spiral, the length of the curves becoming greater towards the tail; yet it appeared probable, as we could only see this eel in confinement, that the peculiarity he alluded to was only developed in producing a change from rest to motion, for which it was well adapted (because the "slip" was great, and the progress small), and that when in rapid motion it was probable that the fin acted in a true spiral.

Mr. Rennie stated that the "slip" of the screw of the *Dwarf* was from $\frac{1}{8}$th to $\frac{1}{9}$th. That with respect to the general question of the "slip," he conceived that it depended upon the comparative resistance between the vessel and the propeller. The case was similar to the immersed plane surfaces of the paddle-wheels of a steamer and of the vessel itself; the resistance of the midship section was reduced by the forms given to the fore and after bodies, which gave the vessel what might be termed more "mobility."

According to the experiments of Mr. Peter W. Barlow, read before the Royal Society, May 29th, 1834,* the "mobility" of several of Her Majesty's steamers was found to vary from $\frac{1}{15}$ to $\frac{1}{24}$th of a plain surface, equivalent to the area of their midship sections; or, in other words, a plane float of 1 foot square, was equivalent to the midship section of the vessel, of which the mobilities were from $\frac{1}{15}$ to $\frac{1}{24}$th. There could be no doubt that the improvements in the forms of the modern vessels, would have produced even less resistance, and he believed that it might now be taken at from $\frac{1}{30}$th to $\frac{1}{40}$th, so that consequently a less area of float or propeller would suffice to overcome the equilibrium, and produce less "slip."

Mr. Smith (of Deanston) observed, that the screw with three blades, which had been used in the *Dwarf*, seemed calculated to produce the best effect. The opening towards the centre of motion, by reducing the arms of the screw blades, as far as the requisite strength would allow, was judicious, as from the comparative slowness of the rotative motion towards the centre, little propulsive effect was produced; whereas the resistance to onward motion, by the arms, if they had not been reduced, might have been considerable; besides, if the arms were in that part broad, there would have been greater tendency to produce centrifugal action on the water. The gradual alteration of the angle of the blade, to the axis of the screw or onward path of the vessel, was also judicious, as it afforded a greater onward action of the blade at the entrance, whilst it gradually curved round to nearly a right angle with the path, so as to leave the water without causing any revulsion; it had thus an action in some respects similar to that of the tail of a fish. The salmon, when it "made a run," put down all its side fins, and solely by the oblique action of the tail was propelled forward with great force and speed, to which the flexibility and form of the tail, and more especially its curving form to accommodate its leaving the water without causing revulsion, principally contributed.

Some years ago, Mr. Smith had made experiments with fans for blowing air, and, so far as he could recollect, the form of greatest effect much resembled in principle that of the propeller under consideration.

Mr. Farey said that, in order to continue the series given by Mr. Rennie, of steam vessels, which had been recently constructed with screw (or rather oblique-acting) propellers revolving under water, it would be desirable that the meeting should have the particulars of a vessel called the *Napoléon*, which had been built at Havre by M. Norman, and fitted with engines and machinery constructed in this country by Mr. Barnes.

Whilst at Havre last summer, Mr. Farey had very minutely examined that vessel, and he considered it equal to anything that had yet been executed of the kind, and a fair specimen of the perfection to which that mode of propelling, had (up to the present time) been brought for sea-going vessels. Mr. Barnes and M. Norman were well known in their respective departments, and they had been accustomed to co-operate during some years past. The engines which had been made and sent by Mr. Barnes to France, and fitted in vessels constructed by M. Norman, had, in most cases, paddle-

* "An Investigation of the Laws which govern the motion of Steam Vessels, deduced from Experiments, by Peter W. Barlow, C.E." Phil. Trans., 1834, p. 309.

wheels, with moveable or mechanical paddles, on the plan introduced by M. Cavé, which possessed a decided advantage over ordinary paddle-wheels; the loss of power occasioned by the paddles entering and leaving the water too obliquely, being much diminished. In comparing the performance of the *Napoléon*, with vessels fitted with those mechanical paddles, there was less effect produced by the oblique-acting submersed propeller, when considered merely as a mode of employing a given amount of power, to propel a given vessel through the water in a calm; but if the same power, as the engines of the *Napoléon*, had been applied with mechanical paddle-wheels at the sides of the vessel (such as Mr. Barnes had been accustomed to construct), the vessel would have had more speed in calm weather and smooth water, than had been attained by one revolving propeller, with oblique acting blades, applied under water at the stern; and it was possible that a greater amount of speed might have been attained, even with well-proportioned common paddle-wheels.

Nevertheless, the submersed propeller at the stern admitted of the use of sails, in concert with steam power, or in lieu of it (when the wind was strong, and in a tolerably favourable direction), with much greater advantage than could be done in steam vessels, with the ordinary or even mechanical paddle-wheels, although the latter were well adapted for acting in concert with sails, because they would perform well, when the paddles were either deeply or slightly immersed. The proper and most advantageous action of ordinary paddle-wheels was very greatly impaired, by variations of immersion; the mechanical paddles (when properly proportioned) were less influenced, and the submersed propeller still less; in fact, being wholly under water, at all times, its action did not appear to be sensibly affected by any such alterations of the depth of its immersion, as were likely to take place in the roughest waves, or the greatest variations of draught.

When all circumstances were considered, it might be safely concluded that vessels fitted with revolving submersed propellers would answer well for making regular sea voyages, either in winter or summer; and, on an average, he thought that their passage would be performed at least as well (if not better) than those of any steam-vessels now in use, and with an economy of fuel, arising from such vessels making a more advantageous use of their sails, and less use of their engine power.

M. Norman, in reply to questions from Mr. Rennie, regretted that his slight knowledge of the English language not only precluded him from fully comprehending the narrative of the paper, and the statements of the several speakers, but also rendered it obligatory that he should communicate to the meeting in French the few remarks which he could not withhold after the pressing notice of the chairman.

Many experiments had been made in France, with screw propellers by numerous inventors, as far back as the latter part of the 18th century, and by M. Cavé and others at recent periods; but the most extensive experiment was that of the *Napoléon*, for which Mr. Barnes had constructed the steam-engines and machinery in England, and which, he might be allowed to say, had given complete satisfaction.

The *Napoléon* was built at Havre, and launched at the latter end of 1842, for the service of the French Government Post-Office in the Mediterranean. The vessel was built of oak timber, copper fastened and coppered. Its dimensions were as under:—

	Metres.		English feet	in.
Length of vessel from stem to stern..........	47·5	=	155	8
Ditto at the surface of the water	45·2	=	148	6
Extreme breadth	8·5	=	27	8
Ditto ditto at the surface of the water	8·32	=	27	4
Draught of water when light loaded, abaft	3·6	=	11	10
Ditto ditto forward ..	2·26	=	7	5

	Sq. metres		Sq. ft.
Area of the midship section, at the above draught of water	13·4	=	144
Ditto of the surface in contact with the water, occasioning friction ..	401	=	4320

The revolving propeller was fixed in a ace or opening abaft the usual stern-post o which, in an ordinary vessel, the rudder ould be hung), and withinside another ern-post, which was erected on a prolonga-on of the keel, farther aft, for sustaining e rudder, so as to leave a space between the two posts, for the reception of the propeller. The centre of the propeller was (1·82 metre =) 6 feet beneath the surface of the water; its diameter was (2·28 metres =) 7 feet 6 inches, and the highest point of its periphery was 2 feet 3 inches below the water line, when the mean draught of water aft was about 11·82 feet.

Four propellers of the same diameter, but

of different forms, were made, in cast-iron, under the direction of Mr. Barnes, and were tried with various success during the past year. The propellers had been altered several times, and it was found that within certain limits, by cutting away the ends so as to shorten the length of the screw, (which had also the effect of diminishing the surfaces of the blades) the speed of the vessel was increased, and the vibration was reduced; a portion of this effect had, however, been attributed to using four arms. A propeller with three blades, occupying the whole of the circle, was first tried; others which presented less central surface answered better, and the best, which was still in use, had four blades, which occupied six-tenths of the area of the circle, when viewed in the direction of the axis, leaving four-tenths of that area vacant for the free escape of the water between the blades, whose obliquity was such as to produce an advance of (3·12 metres =) 10 feet 3 inches in a revolution.*

The steam-engines were nominally of the power of 65 horses each, = 130 horses together: their cylinders were 45 inches in diameter, their pistons making usually from 27 to 28 double strokes of 3 feet 6 inches in length per minute. The motion was communicated to the propeller by a spur wheel of 126 teeth, working into a pinion of 29 teeth, which gave nearly 4¼ revolutions for each stroke of the engine, or about 120 revolutions of the propeller per minute. The ordinary speed of the vessel, without any sails being used, was 10 knots or 11½ statute miles per hour. She had three masts of considerable height, the rigging being that of a brig forward and that of a schooner at the main and mizen masts, with as great an extent of canvass as would be used in any sailing yacht. When the wind was favourable and the sails could be used, the speed increased to 11 or 12 knots per hour.

After a series of experimental voyages, the vessel had gone to her station in the Mediterranean, where she was now in constant service, and had gone through some rough weather with great success; her motion was described as being remarkably easy, she rolled very little, steered better than ordinary vessels, for the propeller appeared to give increased effect to the rudder, and the propeller had never been observed to show itself above the water even in the heaviest seas, when the pitching was at its maximum.

Mr. Galloway remarked, that the properties of a screw, with an increasing pitch, had been slightly investigated by Tredgold,* in his work on the Steam Engine, so early as 1827. That author had briefly referred to the subject of screw propellers, and had given some logarithmic calculations of their properties, from which he drew the conclusion, that the true screw could not be carried beyond a single convolution, with any good effect; whereas by a progressive increase of the pitch, the propelling effort would be continued, until the spiral became expanded into a straight blade parallel to the axis. It was Mr. Galloway's opinion, that more was to be expected from ascertaining the best position for placing the screw, with reference to convenience and effect, than from any slight change in the form or the number of the blades of propellers.

Mr. Samuda said it appeared to him, that the action of the propeller tended to drive the water from it at a right angle with its surface, and as it formed a diagonal line with the keel of the vessel, some portion of the force was not efficiently used for propulsion; he conceived therefore that by a judicious arrangement of shrouding, round the extreme circumference of the propeller, the diagonal currents of the water, might be diverted into a direction parallel with the way of the vessel, and thus cause the whole of the reaction to become available for propelling. Such an arrangement would enable propellers of a much coarser pitch to be employed, and their speed being reduced in proportion, they could be more readily driven directly by the engine, without the intervention of bands or gearing.

Mr. Norman said, that M. Cavé had tried a series of experiments on screws of various forms working in cylinders; and also, he believed, with shrouding on their extremities, and he understood that no advantage had been found to result from such modifications.

Mr. Cowper presented an instrument, which he had exhibited when the aërial machine was incidentally mentioned; it consisted of a fan composed of three or more blades, set at a regular curve upon an axis. When this axis was placed vertically in a socket, and a rapid rotary action communicated to it, the fan rose in the air to the height of between 100 and 150 feet. On reversing this fan and using the same propel ling force, it would not rise at all. This fac evidently showed that the action of the curve fan upon the air, or of the propeller upon th water, was like that of a screw in a solid every part of the surface of the blade of a

* Mr. Steinman claims the propeller of the *Napoléon*, as being also on Blaxland's principle. See his pamphlet, p. 9.

* Vide "Tredgold on the Steam-engine," 1s edit., 1827, p. 310.

well-formed propeller producing its portion of effect.*

Mr. Cowper directed attention to the contrary effect produced by two fans of similar areas, whose arms were, in the one case, mere planes set at an angle with the axis, and in the other, blades forming part of, and being placed at a given curve round the axis. If it were supposed, that the surface of each blade was divided into a given number of equal parts, when the fan, of the former or angular shape, was set in motion, the first part impinging on the air, communicated a movement to it, and the second and succeeding parts finding no resistance from the disturbed fluid, the body had no tendency to rise; but in the latter, or curved-shape, the second and succeeding parts tended to overtake and act upon an undisturbed fluid, and thus had a tendency to rise upon an irregular inclined plane, described by its gyration through the air.

By the law that the resistance increased as the square of the velocity, he conceived that in adapting propellers to vessels, their dimensions should be proportioned, not only to the area of the midship section, but also to the speed of the engine. At the same time, the consideration of the form of the blades was very important. In experiments with the revolving fan instrument, he found, that although, on all occasions, the same rotative force was applied, a fan with three arms, whose united areas were 3·721 inches, when set at a given angle, did not rise freely; the same form and area, when set to a proper curve, rose to a very considerable height; but when a fan of twelve arms, formed from a circle or disc of 28·274 inches area, divided into twelve arms, was set in motion, it would not rise at all. With other fans of intermediate forms, areas, and curves, various results were obtained, which were curious problems for engineers interested in the construction of propellers.

Mr. Grantham expressed his pleasure at finding his paper had so much excited the attention of the meeting, and he hoped it would be followed by communications from members who had devoted more time to the subject: for instance, the numerous experiments made by Mr. Brunel and Mr. Guppy, before deciding on the use of the screw-propeller for the *Great Britain*, and those made in the presence of the Government engineers, Mr. Lloyd and Mr. Murray, on board the *Bee*, the *Rattler*, &c., would be very interesting. Mr. Grantham exhibited a diagram of the propeller used on board the *Liverpool Screw*; it was composed of four blades with broad shovel ends, fixed at a mean angle of 45°. This form, although very successful in this case, could not, he thought, be recommended for large diameters. The results of his observations induced him to think, that the blades of a propeller

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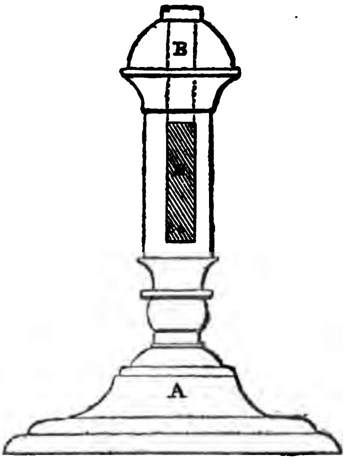
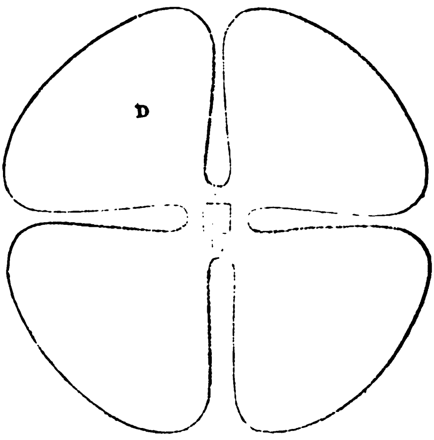
* We subjoin a more particular description of the instrument referred to, with which we were recently favoured by a correspondent (Dicque).—Ed. M. M.





A is a pedestal of wood; B is a hole bored therein to receive the spindle of the fan wheel, D, fitted into the square hole in the centre thereof; E is a slot cut in the shaft of the pedestal, by means of which whipcord may be wound round (previously being passed through the hole C in the shaft of the spindle,) to give impetus to the fan, or screw wheel, D It is, in fact, in every respect similar to the humming top in principle. The fan wheel D is keyed to the spindle to keep it in an upright position, acting as a tail.

should not be more than 4 feet apart; he would therefore advise the adoption of Ericsson's form and mode of construction, which he considered the best that had been hitherto introduced; the ring within the arms permitted any number of blades to be affixed, and a large area of acting surface, judiciously disposed, could thus be obtained. He objected to propellers with three arms, chiefly on account of the small amount of surface obtained.

As to the "slip" which Mr. Galloway had so ably commented upon, he was aware that it did exist in all cases, but he was of opinion that the amount was exaggerated; he had not only made accurate experiments with Massey's log, but being repeatedly in a small boat, which was towed close astern of the *Liverpool Screw*, he found that there was a very slight disturbance of the water, and that there was not any depression behind the blade of the propeller on entering the water; this could be easily observed, as a portion of the upper blade was always above the surface. It had been anticipated that this arrangement would, with so short a vessel as the *Liverpool Screw*, have caused a constant tendency to bear over in one direction, but not the slightest disturbance of the steering was perceived, and the vessel's course seemed to be quite as straight as it would have been with paddle-wheels.

Mr. Grantham wished it to be understood that his object in bringing forward the account of the *Liverpool Screw*, was not so much to cite that vessel's powers, as to point out the feasibility of working propellers at a slower speed, and that condensing engines could be applied with advantage, avoiding the bands and gearing, which had hitherto been found so objectionable.

Mr. Braithwaite was of opinion that where deep immersion was not practicable, two propellers would be preferable, in order to prevent any disturbance in the steering. Captain Ericsson had adopted that plan in boats of light draught.

Mr. Braithwaite then presented a drawing of the midship section of the *Princeton* American frigate, showing the elevation of Ericsson's engine on board. The vessel was 164 feet long, with a breadth of beam of 30 feet; the depth of the hold was 22 feet 6 inches, the draught of water was 17 feet 6 inches, and the burthen about 700 tons; the propeller was 14 feet in diameter, with six blades, and made from 32 to 36 revolutions per minute, at which rate the vessel's speed was stated to be nearly 14 miles per hour. The engines were about 400 horses power; they were of peculiar construction, having two steam cylinders or chests, containing vibrating pistons or flaps, with cranks upon the ends of the suspending pivots; both these were coupled by connecting-rods to a main crank on the driving shaft; the length of these cranks being so proportioned, that their alternate vibrations should give a rotary motion to the main crank, and thus act directly upon the propeller, without the intervention of bands or gearing.*

This principle was tried successfully in the year 1839, by Ericsson, on the Thames, in a tug-boat named the *Robert Stockton*,† after the projector, who had succeeded in introducing the system to the American Navy, and now commanded the *Princeton*.

The boilers of the *Princeton* were constructed for burning anthracite; the whole of the machinery was so placed as to be out of the reach of shot, and the vessel was ship-rigged, so that by unshipping the screw, she could be rendered as effective as any sailing vessel, with a fair wind, or in case of accident to her machinery. Mr. Braithwaite hoped in a short time to bring before the institution an account from Captain Ericsson, not only of the *Princeton*, but of several of the other vessels he had fitted with his engines and propellers, since his residence in the United States.

Mr. Galloway said, that during the experiments with the *Archimedes*, a proof had been elicited that the following current had a very considerable effect on the action of the propeller. During one of the trials the vessel was backed astern, when it was found that the speed of the engine increased three or four revolutions per minute, while the speed of the vessel appeared to have diminished. This experiment was, he contended, conclusive as to the fact that the "slip" was greater than would appear by looking merely at the rate of the vessel compared to that of the screw. He did not, however, think that the "slip" ought to be considerable with a well-constructed propeller. Increased magnitude in a screw would have the same effect in creating resistance, as increased magnitude in any other submerged body. The utility of the increasing pitch, however, was involved in, and solely dependent on, the amount of "slip" which would be found to be attended with the least disadvantageous results in other respects; and here Mr. Galloway would observe that Mr. Cowper's experiments with the revolving fan instrument confirmed his view; for it must be recollected, that there the "slip" was much greater than the rate of ascent; the only condition being thus developed in which the utility of an increasing pitch could be contended for.

* Vide *Mech. Mag.*, vol. xxxii., p. 290.
† Ibid., vol. xxx., p. 281.

The advantage of turning the propeller by the direct action of the engines, was generally acknowledged. The method of driving it was nearly the only problem remaining for solution, and that difficulty being once overcome, screw-propellers must necessarily, from their vast advantage over paddle-wheels, in every respect but that, be universally adopted.

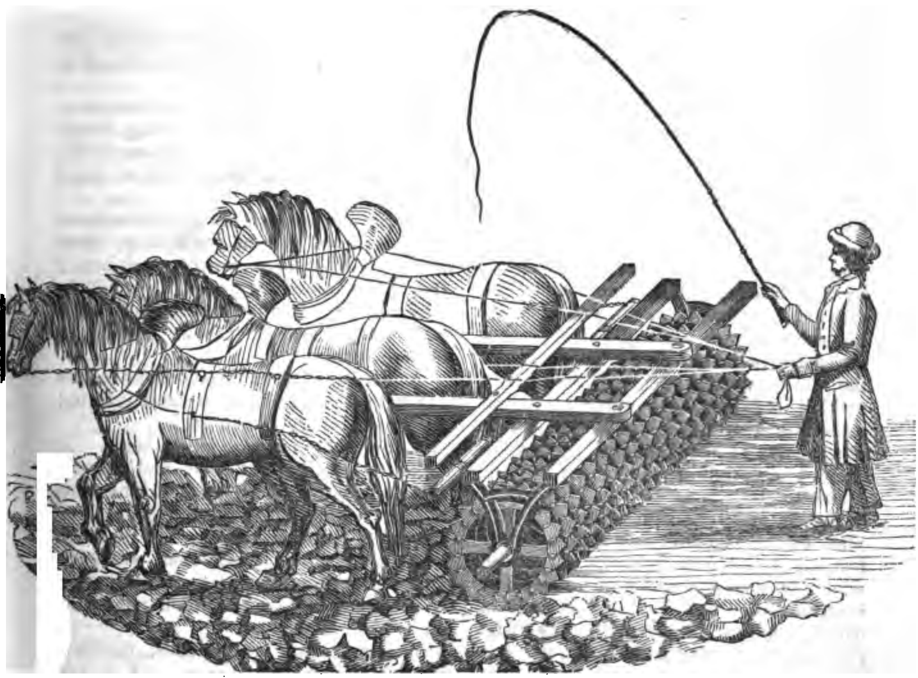
Mr. Hawkins said that about the year 1825, Mr. Jacob Perkins adapted to the stern of a canal boat, a propeller of about 25 feet in circumference, which might be described as resembling two sets of wind-mill vanes, the solid axle of one set revolving within the hollow axle of the other, the two axles being turned in contrary directions, and the dip of the blades being about half their radius. The propulsive force was stated to have been very effective; the experiments, which were put an end to by the breaking of part of the engine, were never renewed, in consequence of disputes among the patentees; but he considered that propeller as the best that had hitherto come under his notice, and he had endeavoured to draw attention to it by reading an account of it, at the Meeting of the British Association at Cork, in 1843.

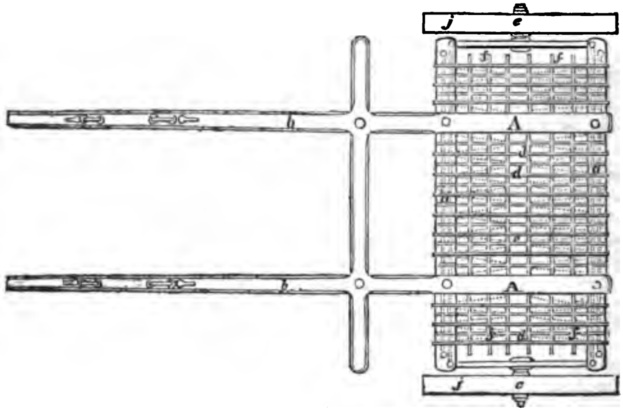
Mr. Grantham stated, that in order to test the comparative effect of the expanding pitch, Mr. Woodcroft had adapted to the stern of a vessel, two screws of equal area, one being of a regular, and the other of an expanding pitch; they were connected by a cross shaft, and were worked by manual power, and it was found that the vessel always yielded to the impulse of the expanding pitch propeller, and was turned by it from the direct course.

With respect to the advantage of a large amount of surface, he had found that the action of the propeller of the *Liverpool Screw*, which had been enlarged three times, was decidedly improved by the alterations; the speed of the engines always remaining the same.

Mr. Galloway said, that the surface of the propeller of the *Liverpool Screw* might probably have been too small at first, and therefore each increase would naturally improve its effective power. The area of the propeller should be in proportion to the body to be moved; this law was common to screw-propellers and to paddle-wheels.

CROSSKILL'S PATENT CLOD-CRUSHER ROLLER.





The instrument represented in the preceding engravings, furnishes a remarkable instance, at once of the difficulty with which even the most useful inventions find their way into use, and of the utility of the Agricultural Shows which have come recently into fashion in promoting the adoption of improvements in farming implements. The first year it was brought out (1841), two only were sold, and a third given away; in the second year the inventor had no better success, and to tempt farmers to give the machine a fair trial he was induced to lend out several on merely nominal terms of remuneration. At length, at the Doncaster exhibition last year of the Yorkshire Agricultural Society, the machine had the good fortune to obtain the largest prize awarded by the Society; and since then the demand for it has been so great throughout the northern parts of England, that the patentee is now manufacturing it at the rate of two a day. With the view of making its merits still better known, and thereby accelerating its introduction into other parts of the kingdom, we lay the present description of it before our readers.

Fig. 1 is an elevation, and fig. 2 a plan of the machine. A A is a strong framing, and *b b* shafts; *c* is an axis on which is placed a series of rollers *d d*, from the outer circumference of each of which project a number of teeth *e e* and *f f*. Each roller turns freely on the axis independent of the others, and while the teeth *e e* project radially from the rollers, the others, *f f*, project at right angles to them; two peculiarities which distinguish this crusher from all others, and by which not only the earth is penetrated and broken up with more facility, but the teeth are rendered, as it were, self-cleaning.

The purposes for which this roller has been found most applicable are stated to be these:—

1. For rolling wheats as soon as sown, especially when sown on strong lands late in the year, in which case once rolling and crushing is found equal to once hoeing.

2. For rolling corn upon light lands as soon as sown, and in the spring, after frost. It is found to answer much better than the pressers upon light soils, to which it gives a suitable degree of firmness and tenacity, without leaving a smooth surface.

3. For rolling corn three or four inches out of the ground, upon land infested with the wire-worm and grub.

4. For rolling strong fallow lands. It breaks up the hardest clods, and pulverizes them into a fine mould, making sure of a sowing season in the driest weather. By once or twice rolling, the machine will pulverize the largest clods, and give a fineness of surface far surpassing what is produced by the spike roller, or any other implement.

5. For rolling grass lands, meadow lands infested with worms, and moss

lands. A plain roller is afterwards used.

6. For rolling between rows of potatoes, &c. It is worked between three or four rows at once, by taking off the required number of roller-parts, and placing iron bushes in the spaces required, so that the roller-parts do not injure the plants.

It will, of course, be understood in every case, that the machine can only be used when the land is so dry as not to stick to the teeth.

LIGHTHOUSE FOR THE ISLAND OF BERMUDA.

The cast-iron lighthouse for the Jamaica lighthouse commissioners, which was constructed at Messrs. Bramah and Robinson's manufactory three years ago, and erected on the east end of Jamaica a few months afterwards, on the specification and under the immediate superintendence of Alexander Gordon, Esq., C.E., has given so much satisfaction,* that the Lords of Her Majesty's Treasury were induced to contract with Mr. Gordon for the construction of a similar lighthouse, but on a still larger scale, for the top of Gibb's Hill, on the main island of Bermuda, where numerous engineering difficulties have hitherto prevented the erection of a lighthouse in masonry. The work has been several weeks in progress, and may now be seen rising above the houses near the Waterloo-bridge-road. The constructors of the iron work are Messrs. Cottam for the tower, and of the lantern, Messrs. Wilkins and Son, of Long Acre.

The tower is conical, and the diameter at the base 25 feet, tapering to 15 feet at the narrowest part near the top, when it is sponsoned out for the gallery on which the lantern is to be placed. The total height, from the base to the top of the lightning rod, will be 138 feet, and when erected on Gibb's Hill, Bermuda, will be 368 feet above the level of the sea. The lantern is to be fitted with a lenticulated apparatus of the first order, on Fresnel's plan, and the light (a fixed one with bright flashes) will be visible all round the dangerous reef of rocks to the northward and westward of this valuable military and naval station in the Atlantic Ocean.

The outside carcase of the tower is composed of 139 cast-iron plates. There are seven rooms, lighted by portholes and ports, fitted with plate glass. The rooms are lined with wrought iron, panelled in oak frames, and the ascent from the bottom to the top is by means of a spiral staircase of iron with oak treads. The floors are all of cast-iron, and there is in the centre a hollow column, 16 inches in diameter, for waste water-pipes, and for the ascent and descent of whatever may be required in the lightroom and lantern, or for any of the seven rooms, thus obviating the necessity of carrying anything up or down the staircase.

The whole is constructed with a special view to the resistance of those terrific hurricanes and thunder storms so common in Bermuda, and some of the West India islands. Being a perfect conductor of electricity, no lightning can affect it; being also incombustible, it cannot be destroyed by fire. Altogether, in short, it gives the fairest promise of being another lasting monument of the engineering talent of the mother country.

Mr. Gordon's lighthouse at Jamaica we described at the time of its temporary erection in this country, three years ago. It has several times been struck by lightning, but without sustaining the least injury.

THE FACTORY QUESTION.

Suppose the expense of building and fitting up a cotton factory with the necessary machinery, &c. to amount to 180,000*l.*, and that the proprietor will require, to keep it in full operation, a floating capital of 20,000*l.* He engages 800 hands, whose average annual wages may be rated at 30*l.* each; the other miscellaneous expenses may be taken at

* *Extracts from the Report of the Lighthouse Commissioners to the House of Assembly, Jamaica, December* 15, 1842.—"Mr. Gordon lost no time in meeting the wishes of the Commissioners, and in a weeks submitted to them the plans of several ers, with reports and explanations as to the nable expense, and a recommendation of the he considered best suited to meet the object emplated. * * * On the 8th March, 1841, the a tower recommended by Mr. Gordon was seted, and finally determined on, and instructions en to proceed with the work. These instrucus were promptly attended to by Mr. Gordon h a zeal and alacrity which enabled that highly ented gentleman to inform the Commissoners, y eight months after, that the tower was about be shipped for its place of destination. * * * the evening of the 1st May, 1842, the light was ibited, and has since continued to be in full opeon."

5,000*l.* per annum. Now, suppose we allow the proprietor, in the name of interest for expenses of building, tear and wear of machinery, insurance, &c., 7 per cent. on the sunk capital, and 3½ per cent on the floating capital, and that the proprietor's annual gain is 10,000*l.*; it is then required to determine what his annual gain will be when the daily hours of labour are reduced from 12 to 10, the wages remaining the same? And what also will be his annual gain when the wages are reduced in the ratio of the hours of working?

	£
The interest on the 180,000*l.* at 7 per cent., is	12,600
Ditto on the floating capital of 5,000*l.* at 3½ per cent.....	700
Wages of 800 hands at 30*l.* each	24,000
Miscellaneous expenses	5,000
Proprietor's annual gain	10,000
	£52,300

That is, the annual value of the work produced by all the hands amounts to 52,300*l.* Now when the hours are reduced from 12 to 10, the annual sum produced will be ⅙ less than the above sum, or, 43,583⅓*l.* Hence, by the reduction of the working hours from 12 to 10, the wages remaining the same, the proprietor's annual gain will be diminished by (52,300—43,583⅓) 8,716⅔*l.* and his net income will be (10,000—8716⅔) only 1,283⅓*l.*

But should the wages be reduced in proportion to the time, the proprietor will save ⅙th of 24,000*l.*, or 4,000*l.* which will raise his annual profit to

(1,283⅓ + 4,000) 5,283⅓.

Or, suppose a stoppage of 3 months in 12 were to take place, the daily time of working being still twelve hours, and that the proprietor were to allow the hands half pay when unemployed, then—

	£
From the original total of ..	52,300
Subtract ¼ for 3 months....	13,075
	39,225
Subtract also ⅛ of 24,000*l.* for half pay	3,000
	36,225
Balance of 52,300*l.*........	42,300
Loss..........	£6,075

In this case the proprietor would sustain a loss of 6,075*l.* per annum.

Corollary.—52,300 ÷ 800 — 30 = 35,375, is the proprietor's amount of gain on each hand, and 10,000 ÷ 35,375 =283; hence 800—283 = 517; that is, if the proprietor were to reduce the number of hands from 800 to 517, his annual gain would be 0.

GEORGE SCOTT.

41, Seymour-place, Bryanston-square,
April 26, 1844.

A FEW FACTS RELATIVE TO THE RISE AND PROGRESS OF THE COTTON MANUFACTURE OF THIS COUNTRY.

Sir,—I beg leave to forward to you the accompanying "Facts," which, as the descendant of Mr. John Kay, of Bury, I have considered it my duty to lay before the public. As they are not generally known to the mechanics of Great Britain, I hope they may not prove uninteresting, and am, Sir,

Your obedient servant,

THOS. SUTCLIFFE.

Royal Hotel, Liverpool,
April 16, 1844.

Facts, &c.

Mr. Guest, in his interesting work on the Cotton Manufactures, in alluding to that ingenious mechanic, who, in 1764 and 1772, invented the spinning jenny, waterframe, and a machine for carding, has justly said, that "nothing is more singular, or shows in a stronger point of view the great evanescence of individuals, and the knowledge of circumstances affecting them in Manchester, arising principally from its great increase in new settlers, and population, and the great fluctuation of its inhabitants, that a man of such celebrity, and so well known to the last generation of Manchester merchants and manufacturers, as Mr. Thomas Highs (*of Leigh, in the county of Lancaster*), should be now almost forgotten." Yet thirty-four years previous to Mr. High's invention being improved by Messrs. Hargreaves, Arkwright, and Crompton, *the reputed "first fathers,"* and the factory system established: "*the long-closed door to the era of inv tion*" had been opened by Mr. John K of Bury, in 1738, by his improving loom, and accelerating the speed of t shuttle.*

At the period of Mr. Kay's inventior nearly all the woollen and linen goods, wer. manufactured in the country by small far mers, or others who rented cottages. The received the material in a raw state, whic

* Vide Aikin's History of Bury.

was carded by the hand, and spun with the distaff and spindle: hitherto there had been no scarcity felt of warps or weft, what was most needed were men to weave, on account of the tedious mode of throwing the shuttle by the hand, and its requiring two persons to weave any cloth that exceeded thirty-six inches in width; thus Mr. Kay *enabled one man to weave double the quantity he had done before, unaided.* This useful, and beneficial invention, was opposed by the operatives, who were afraid they would lose their employment, as it required six or eight persons to supply one weaver with weft.*

Soon after the fly, or wheel shuttle, got into general use, the attention of artificers was excited to supply the deficiency of warps and weft; and, although it was computed that more than "50,000 spindles were turned by as many individuals daily in Lancashire, the weavers, who were urged on by their masters, were perpetually at a stand for want of weft." Mr. Kay's next invention was a machine for making several cards at one time, by a person simply turning a shaft: this machine stretched the wire out of the ring, cut it into lengths, stapled, and crooked it into teeth, row after row, till the cards were finished. Mr. Kay made many more improvements in machinery, and his son Robert invented the drop box, in 1764, by which a weaver could at ease use one of three shuttles, and thereby produce a fabric of three colours with nearly the same expedition as he could weave a common calico; he also improved the machine for making cards, the model of which is still in possession of his grandson, Thomas Oram, Esq., of Bury.

Mr. Kay's inventions were secured to him by patents, "which, far from answering the gracious intention of His Majesty George the Second, was evaded by many people, especially those who made and sold the wheel shuttle; the simple mechanism of it, which adds to the merit of the invention, rendering its imitation so easy, that it was almost impossible to be prevented; he therefore had no other way left to do himself justice, and reap the benefit of his inventions, but by suing those who evaded and acted in defiance of His Majesty's patents; which unhappily involved him in so many tedious law and chancery suits, that though he gained his suits, the expenses were so heavy, *he found himself at last obliged to yield to the torrent.*"*

The combinations formed against him by those who pirated his inventions, as well as the working classes, who were all against him, put his life in jeopardy,† and at last he was obliged to take refuge in France.‡

The Right Honourable Francis North, first Earl of Guilford, who had married a relative of Mr. Kay, did interest himself, as well as the Right Honourable Lord Strange; but before anything could be done with government for that "*Lancashire worthy,*" he died in Paris, a victim of *national ingratitude.*

Nothing can authenticate the important service Mr. Kay rendered to this country more fully than the following extracts, taken from the Annals of Manchester, and other local publications.

"In 1735, the population of Manchester was 20,000; in this year St. Ann's Square, the south side, King-street, and Ridge Field were first built upon; and Ardwick was a detached village, cut off from Manchester by nearly a mile of cultivated fields. The Collegiate Church, built in 1422, St. Ann's Church, built in 1709, a chapel, and three others belonging to the Dissenters, were the only places of worship in the whole parish. A Post Office was established, and it took eight days to receive an answer by return of post from London."§

England was at this period considered to be the rival of her continental neighbours in foreign markets, yet no progress had been made in either imports or exports during the first fifty years of the 18th century, nor had any improvements been made in machinery, as the manner of producing yarn and weft was by the distaff and spindle, as used from time immemorial; and the manner of warping and casting the shuttle, &c., was the same as when the Flemish clothiers introduced their craft into Great Britain, in 1837; and it is impossible to calculate how long the "*era of invention*" would have been kept in abeyance, had not John Kay, of Bury, conceived the idea, and by improving

* This was the grand "*premier pas,*" the first step which led to the extension of the cotton trade, through the civilized world; and however meritorious may have been the subsequent improvements, the sagacious mind that first opened the long-closed door to this wonderful discovery, must be ever entitled to the praise of an original and powerful genius.—*Clarke's Lancashire Gazetteer.*

* Mr. Kay's case, vide "Exposition of Facts."

† It is recorded in Bury, that when his house, &c., were once gutted by a mob, he had to escape from their fury by being taken out of the town in a wool sack!

‡ So hard is the fate of inventors; when they fail, no one pities them, when they succeed, persecution, envy, and jealousy, are their reward. Their means are generally exhausted before their discoveries become productive. They plant the vineyard, and either starve, or are driven from their inheritance before they can gather the fruits. This melancholy truth is exemplified at every stage of the cotton manufacture, which is the creature of mechanical inventions.—*Baines's History of the County Palatine of Lancaster.*

§ Annals of Manchester.

the loom, and accelerating the speed of the shuttle, &c., gave that "*grand premier pas*," which led to the extension of the cotton trade throughout the civilized world," a single glance at the following tables of imports and exports *will corroborate this assertion*.

Cotton imported.	Cotton goods exported. Official value.
1701—1,985,808 lbs.	£23,253
1720—1,972,805	10,200
1741—1,845,031	20,509
1751—2,976,610	45,986
1764—3,876,392	200,254
1780—6,700,000*	355,060

What a contrast when compared with the first fifty years of the last century!

It may be well to remark that Liverpool in 1700 "was only a tributary township to the village of Walton,"† yet under the influence of the manufactures it has since that period become, in opulence, magnitude, elegance, and commerce, the second seaport in Europe. I may also add that Liverpool, Manchester, and Salford had more than doubled their size and population. The Duke of Bridgewater's canal from Worsley to Runcorn, was finished, and other canals projected, as well as many beneficial improvements made in Lancashire during the period Mr. Kay's inventions *were the only machinery in general use*.

Previous to the factory system being introduced, and the first steam-engines erected by Messrs. Peel & Co., in Warrington, in 1788, and Mr. Arkwright's, in Manchester, in 1789, it was estimated that the cotton manufactures alone employed 150,000 men, and 90,000 women; and the population of Manchester was estimated at 50,000 souls; and now, in 1844, when Mr. Kay's important services may be fully estimated, and when the quantity of cotton manufactured in Great Britain in one year is said to be five hundred and twenty-eight millions of pounds, and the official value of the fabrics wrought in our manufacturing establishments has risen to *sixty millions sterling*; I may presume to advocate the case of the descendants of Mr. John Kay, of Bury, and as "*a sufferer by the national ingratitude*" to that "*great public benefactor*,"‡ strive to draw the attention of my countrymen to our claims, by publishing these facts, in order that they may judge whether gross injustice has not been done to the man, whose ingenious inventions have contributed to advance the wealth of thousands, and to the increase of the importance of Great Britain.

The following powerful precedents may justify my having made an appeal to the dispensers of the public bounty, and other personages.

In 1809, Mr. Cartwright received a Parliamentary grant of 10,000*l.* for his invention of a power loom in 1785.

In 1812, Mr. Samuel Crompton, of Bolton, and Mr. Wright, of Manchester, received each a parliamentary grant of 5,000*l.* for their inventions of the single and double mule.

In 1842, Mr. Wm. Radcliffe, the ingenious inventor of the dressing machine, received a grant from the Royal Bounty Fund of 150*l.*; and subsequently the descendants of Mr. Samuel Crompton and Mr. James Hargreaves, received grants of 200*l.* and 250*l.*

In conclusion, I beg leave to submit the following questions to my countrymen, since the descendants of Mr. John Kay have not been considered worthy of the consideration of the dispensers of the public bounty:—

Ought not Mr. Kay or his family to have been remunerated for the losses both sustained when he was forced to fly his country, *and leave his patented machinery* to be the common prey of his ungrateful countrymen?

Ought not Mr. Kay's descendants to be justly entitled to "*claim from the dispensers of the public bounty, the same degree of consideration, which has been shown to*" *others* "*whose merits were not greater?*"

And lastly, Is it yet too late to erase the name of John Kay, of Bury, from "*the catalogue of merit neglected and genius unrewarded?*"

THOS. SUTCLIFFE.

Bury, March 13, 1844.

* "The importation of 7012 bags of cotton, into the whole kingdom, between December, 1782, and April, 1783, occasioned quite a panic at Manchester. Last week about 200,000 bags were imported into Liverpool alone."—*Liverpool Mercury, March* 24, 1843.

† History of Lancashire.

‡ "Chamber of Commerce and Manufactures of "Manchester, 19th December, 1842.

"Sir,—The Directors of this Chamber have heard read the various communications with which you have favoured them, relative to the circumstances in which the descendants of John Kay, the inventor of the fly-shuttle, seem unhappily to be placed.

"I am to express to you the opinion of the Board, that, however warmly they may sympathize with the hard fate of those, who, from their relationship to a great public benefactor, would seem to have deserved better things, they cannot, as a chamb assist you in the manner you desire. It is a fix principle with the Board, not to interfere in the plications of individuals, either for appointments, or grants of public money; and however justly you, as one of the sufferers by the national ingratitude to John Kay, may claim from the dispensers of the public bounty, the same degree of consideration for the needy descendants of that man, which has been shown to the relatives of another, whose merits were not greater, the Board cannot depart from the rule on which it uniformly acts. I have the honour to be, Sir, your very obedient servant,

"THOMAS BOOTHMAN, JUN., Secretary.

"Thomas Sutcliffe, Esq., Manchester."

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MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1083.] SATURDAY, MAY 11, 1844. [Price 3*d*.

Edited by J. C. Robertson, No. 166, Fleet-street.

BORRIE'S STEAM ENGINE DISCONNECTING APPARATUS.

Fig. 1.

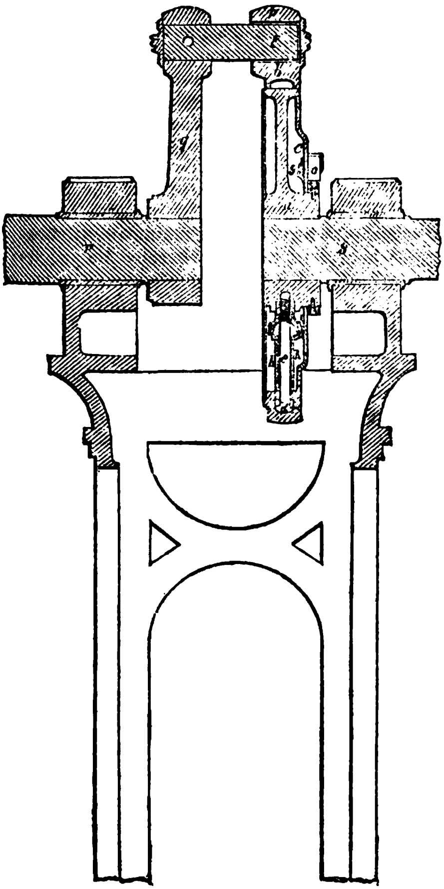


Fig. 2.

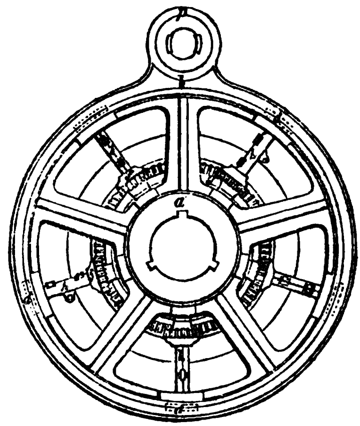
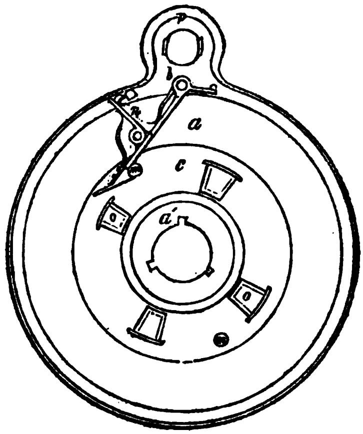


Fig. 3.



MR. BORRIE'S PATENT SAFETY-FRICTION WHEEL FOR DISCONNECTING PADDLE-WHEELS, AND OTHER MACHINERY.

[Patentee, Mr. Peter Borrie, Engineer, Princes-square, Saint George's East. Patent dated August 3, 1843; Specification enrolled February 3, 1844.]

Fig. 1 of the prefixed engravings represents a section of this friction wheel, with part of the engine framing, &c. Fig. 2 is a front view, and fig. 3 a back view of the wheel.

a, fig. 1, is a cast-iron friction wheel, keyed on the paddle shaft, in the position commonly occupied by one of the cranks; *b* is a wrought iron friction strap, which encircles its periphery, and has an eye-piece *p* forged on it to receive the outer end of the crank pin *t;* the inner end of the crank pin is firmly fixed into the crank Q, which is keyed on the intermediate shaft *r;* a groove is made in the inside of the friction strap *b*, for the five friction plates, *d d*, to act on; these plates are laid in recesses on the periphery of the friction-wheel, and are pressed out upon the friction strap by the screws, *e e*. The method of working the screws is as follows; a cast-iron ring *c* is made to turn freely (when out of gear) on the nave of the friction-wheel *a*, and carries round with it the toothed wheel *g;* this wheel works the five pinions *f f*, each of which is keyed on one of the screw rods (not keyed dead on the rods, but so that they may be lifted out of gear for the purpose of adjusting the screws); each screw rod has a collar *h*, round it, to keep the pinion in its place, and this collar is divided into two halves kept together by hinges, thus admitting it to be easily taken off when the pinions require to be lifted up, for adjusting the screws. On the back of the friction strap *b* a stud is fixed, and upon it a link *k* works, which link again by taking hold of either of the studs, *m m*, connects the friction-strap *b* with the ring *c*, and consequently, (through the medium of the wheel *g*, and pinions, *f f*,) with the screws. The link *k* is represented in the engraving as being in gear, and when out of gear, it is kept out by the spring catch *n*. It will, of course, be understood, that while the engine is in motion, the crank Q, crank-pin *t*, and the friction-strap *b*, are always carried round with it, whether the paddle wheels are connected or disconnected.

To disconnect the Paddle-wheels, supposing the engine be going at full speed; throw in a catch from any convenient part of the engine framing, (this catch can either be worked in the engine room or on deck,) so that it may be in the way of the link *k*, during the course of its revolution, which will lift it out of gear; and let the same catch be made to take hold of either of the studs *m m* (one of which the link *k* has just quitted) and thereby prevent the wheel *g* from turning round. Now, the friction-wheel still turning with the friction strap will cause the pinions to unscrew the screw rods, thus taking the pressure off the plates, and consequently allowing the friction strap to turn without taking the friction-wheel along with it, whereby the paddle-wheels will be disconnected.

To connect the Paddle-wheels again, supposing the engine to move at full speed as before. Throw in a catch from any convenient part of the engine framing to push the spring catch *n* out of gear; the link *k* will then drop into gear, and in moving round will take hold of either of the studs, *m m*, so that the wheel *g* will be turned round with the friction-strap, and will turn the screws until there is sufficient pressure on the plates to carry round the friction wheel, and consequently, the paddle-wheels.

By the simple and very ingenious arrangement which we have thus described, the operation of connecting or disconnecting can be performed (either below or on deck,) almost instantaneously, and while the engines are going at their full speed. This, too, can be done by simply working a handle, connected to the catch in the engine framing, which being pushed in, causes the engine to disconnect itself. The engines may also be disconnected when at rest, by placing a handle in any of the sockets, O O, and turning round the wheel *g*.

MR. WALKER'S IMPROVED PUMP.

Mr. Walker, whose Water Elevator we described in our No. 971, page 210, has invented and patented a pump which is well worthy of his reputation as an hydraulic engineer, and of the attention of such of our readers as require a machine of that description. Its simplicity serves to disguise the merit of the invention, although it adds to its practical value.

One of the greatest inconveniences to which pumps have hitherto been liable, is that of their valves being deranged by small substances drawn in with the water. A chip, a shaving, or a bit of tow, has spoilt the action of many a pump, just when its services were most needed. In a storm, and in distress, a ship could sometimes spare any thing rather than its pumps; and just then, in the midst of confusion and danger, all on board are appalled by the fact, that the pumps are choked. So also the pump of a steam engine may have one of its valves held up, and consequently its action spoilt, by a trifling substance whose passage into it could not be detected or prevented. Sometimes the consequences are of the most serious kind, as in the late case of the *Prometheus*, whose boilers were burnt out for the want of water, arising from a bit of oakum having found its way into the boiler pump. All this is well known to happen, notwithstanding that the water is admitted into the pipe through a perforated guard at the bottom; in the well itself nothing can be done with the necessary minuteness and delicacy to strain out the minute substances which do the mischief. In Mr. Walker's pump the water is made to pass through a filtering chamber before it reaches the pump barrel, this chamber forming part of the air-tight course by which the water rises from the well to the barrel. The pipe from the well passes through its bottom and nearly reaches its top, delivering the water into it: the pipe, by which the water proceeds to the barrel is carried out of it in any convenient direction, and its opening is in a part of the chamber separated from the rest by perforated zink, or wire gauze. By this means the water is riddled before it comes to the valves of the pump, and whatever it has carried up with it is left in the filtering chamber. It is almost superfluous to say, that the chamber is made large enough to contain a considerable quantity of refuse, and the screen, or cylinder of perforated zink, is of such extent, that when a large part of it is blocked up, the remainder shall admit as much water as the barrel can lift. Provision is made for clearing out the filtering chamber conveniently when requisite. We saw wood shavings pumped up, and duly riddled out of the water, which would certainly have choked any other pump with valves.

Another disadvantage in pumps, as commonly constructed, is obviated in Mr. Walker's new one. In the common pump the piston has a valve in it, through which the water passes when the piston makes its downward stroke. This valve is necessarily much smaller in diameter than is the piston itself, and consequently, the water-way through it is very limited, in proportion to the horizontal area of the barrel. Much ingenuity has been employed in devising valves which should reduce this objection to a minimum: but, after all, considerable power is wasted in forcing the water through the narrow and insufficient passages, which even the best valves afford when placed in the piston; nor does the enlargement of the piston and barrel at all remove the difficulty. Mr. Walker avoids it in the following manner: Immediately above the lower, or fixed valve, the barrel becomes considerably larger than in common pumps; and concentrically within it is placed the cylinder, in which the piston works, which cylinder does not reach to the lower valve, the two portions of the space in the barrel freely communicating round its lower edge; the piston is a solid plunger. The annular space between the two cylinders is closed at top by the delivery valve. The delivery valve is thus made very large, so that it needs but a small lift to give free way to the water, and this effect is further increased by the exit being, by the inner, as well as by the outer edge of the ring. Not only is power thus saved, but there is little loss of water during the descent of the valve as compared with that which takes place in pumps on the old plan. By this contrivance power is greatly economised, and the parts are made simple and of easy

repair: the piston being solid is easily kept in working condition, the delivery valve is always in sight, and may be taken out in an instant, while the whole of the pump above the foot valve may be readily removed, in order to examine that important member of the machine. The advantage gained by enlarging the valves is made very obvious by limiting the rise of the delivery valve to that which gives an area equal to what can be obtained on the common plan; when a very perceptible increase of power is realized.

These pumps are found to answer exceedingly well in practice; they have attracted the attention of the authorities of the Navy, and there is reason to expect their general introduction into all our ships of war. Railway engineers, the makers and proprietors of steam engines, and all others who require the use of pumps where their action is very important, and is liable to be deranged by adventitious substances, or consume an amount of power, which it is important to reduce, should examine these pumps before they finally decide on their plans.

INSTITUTION OF CIVIL ENGINEERS. MINUTES OF PROCEEDINGS, SESSION, 1844.

13th, 20th, 27th of February.

[*Supplement to discussion on Screw Propelling.*]

Mr. Perkins stated, that on a recent examination of the *Napoleon* at Marseilles, the cast iron of which the propeller was composed was found to have undergone considerable change, and to have become so soft that it could be cut with a knife.

Mr. Grantham believed that circumstance was owing to the cast iron propeller working too near the copper sheathing of the vessel. Iron vessels would not be liable to that objection. The amount of oxydation was apparently increased by the cast iron remaining in a state of rest; now as screw propellers were usually in rapid rotation, and were also generally so constructed that they could be unshipped, they could be painted and preserved from any injurious amount of external corrosion, although a chemical change might still be induced, when the cast iron was in contact with copper.

General Pasley had observed, in the metal raised from the wrecks of the *Edgar* and the *Royal George*,* that the cast iron was generally soft, and in many instances resembled plumbago; that when small pieces were cut from any of the iron guns, or that these pieces were pounded in a mortar, heat was evolved, but after two or three days the metal cooled again: some of the shot which had been found, had burst into several pieces, under this heating action.*

The wrought iron was not so much injured, except when it was in contact with copper or gun-metal; some of it appeared to have undergone an unequal action, and presented a reticulated surface, as if the softer portions had been destroyed, leaving the harder fibres uninjured.† Those portions of the wrought iron which were used by the smiths in the Dockyards, were declared to be of a better quality than any modern iron. Neither the copper, nor the gun-metal, was much acted upon, unless it was in contact with iron.

Mr. Cottam had observed, with great attention, the iron guns which were brought from the *Royal George* to the Tower; when they arrived they were soft, and could be easily cut with a knife;‡ but when he examined them some time afterwards, the metal had resumed its original hardness. This was frequently the case with pump-trees, which had become soft from immersion in mineral water, but on being taken out and laid aside for a time, they became hard again.

Mr. Galloway stated that this spontaneous development of heat by cast iron, which had been long immersed in salt water, had been frequently observed. A striking instance of this kind occurred at Woolwich, when an attempt was made, to preserve the copper sheathing of vessels from corrosion.

Sir Humphrey Davy suggested to the Admiralty that the decomposition of the copper sheathing could be neutralized, by the application of tin, zink, or any other easily oxydable metal; the plan was tried on several vessels, by attaching to them zink plates, and the protection was so perfect, that the ships' bottoms became covered with barnacles and weeds. Cast iron was then substituted, on the supposition that the partial oxydation, which would be permitted by the iron, would prevent the fouling of the copper, but that the ordinary rapid destruction would be modified.§

* The *Edgar* was sunk in 1711, and the *Royal George*, in 1782.

* A similar action was observed in the cast iron shot raised from the *Mary Rose*, which was wrecked in the reign of Henry VIII.

† This appearance was also noticed by Mr. Mallet, and is mentioned in his paper, "On the Corrosion of Iron, &c."—Vide Minutes of Proceedings, 1843.

‡ Vide also Trans. Inst. C.E., vol. i. p. 204.

§ Vide also Mr. Wilkinson's paper "On the Sheathing of Ships," Minutes of Proceedings, 1842.

The *Magicienne* frigate having been at sea for some time, with cast iron protectors, was docked at Woolwich for examination; when it was found that the protection, instead of being partial, had been local, for while the greater portion of the surface of the copper was oxydized as usual, the parts contiguous to the iron had been perfectly protected, and were covered with barnacles. Mr. Marsh (of the Ordnance department) broke off some small pieces of the iron, which presented the appearance of plumbago, was easily cut, was greasy to the touch, and left black marks upon paper;* in a few minutes the heat became so great, as to ignite the paper in which the pieces were enveloped. The development of heat was generally supposed to proceed from the rapid absorption of oxygen by the mass, on being brought into the air from the water, where it had already received a certain amount of oxygen. The production of heat, being in this case governed by the same law as that under which animal heat and the heat of combustion were developed.

Mr. Homersham said that the water of the Thames, up as high as Richmond, had the same effect as sea-water, in rendering cast iron soft.†

Mr. Simpson believed that if hard grey cast iron, with a good surface, was used for castings which were subjected to the action of sea-water, but little injurious effect was to be dreaded; he was so convinced of the fact, that he was about to use cast iron extensively for piles. He had recently examined some cast iron piles, which had been in sea-water for sixteen years, without any detrimental effect being produced.

Mr. Jordan thought that it was very desirable to mark the difference between the composition of brass and the alloy of copper and tin used in casting guns. With brass, in which zink formed a part of the composition, it was probable that the iron would have been acted upon with less energy, because it was more electro-negative than zink; but the gun-metal acted positively upon the iron, and apparently altered the substance.

Mr. Braithwaite said that the proportions of the mixture used for the bearings of machinery were usually 92 per cent. of copper, and 8 per cent. of tin.

The President said that although the discussion had taken a direction which had not been anticipated, and was foreign to the original subject, he had not attempted to lead it back again, because the question of the causes of the chemical change in cast iron, in certain positions, and the means of preventing it, was of the utmost importance to engineers, particularly as in all modern works so much cast iron was used.

Valves of Pumps.

Mr. J. B. Jordan exhibited and described a model showing the principal pump valves used by mining engineers.

Mr. Jordan stated that the model before the meeting was intended to illustrate mining machinery, and was one of a series now in progress of construction for the Museum of Economic Geology. There were eight differently constructed valves in it, each surmounted by a glass valve-chamber and pipe; the large central pump served to circulate the water through all the valves simultaneously, so as to show their comparative action; the water was then discharged from the collar launders over each valve into that at the head of the pump, so that by repetitions of the pump-stroke the circulation through the valves might be kept up at pleasure.

The valves shown in the model might be divided into four classes:—

1st. Those in which no attempt was made to counteract, or avoid the violence of the beat, or concussion, on closing the valve.

2nd. Those in which that evil was reduced, by dividing the horizontal area of the valve, into several parts.

3rd. Those in which the same object was attained, by reducing the horizontal area of the moving parts of the valve.

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* In Dr. Thomson's "Annals of Philosophy" are the following remarks:—"Dr. Henry states that 'cast iron having been in contact with muriate of lime, or muriate of magnesia, most of the iron was removed. The specific gravity was reduced to 2·155, and what remained was chiefly plumbago, and the usual impurities.'

"Dr. Brande found that 'a cast iron gun had undergone a like change, from being long immersed in sea-water. To the depth of an inch it was converted into a substance having all the external character of plumbago. The component parts were—

Oxyde of iron	81
Plumbago	16
	97'

"Mr. Mushet, in his work on 'Iron and Steel,' states that wrought-iron sometimes, though very rarely, undergoes the same change.

"Professor Daniel, in the 'Quarterly Journal of Science,' vol. ii., p. 290, says, 'I am inclined, under all the circumstances, to believe that the triple carburet, as it is at first obtained, consists of iron and silicum in the metalline state, united to carbon. When brought into contact with oxygen gas, the metals become converted to protoxydes, giving out heat, without separating from the carbon.'

"By analysis, he found the substance to consist of—

Red oxyde of iron	7·0 =	6·2 black oxyde
		4·9 silex
		11·2 carbon.

"The same author states an important fact, bearing on the present question, namely, 'that it took three times as long to saturate an acid, when it acted on white cast-iron, as when it acted on the grey kind.'"

† Vide also Trans. Inst. C. E., vol. i. p. 204.

4th. That in which the concussion was reduced to any desired amount, by making one side or portion of the column, to a certain degree, balance the other.

Valves of the first class were so well known, that they required little description; they were the common pump clack, moving on a leathern joint, and having generally a very small water-way—the improved metal joint clack, in which the water-way was much increased—and the "button clack," or as it was called in Cornwall "Scantlebury's clack," which was a disc of metal with a central spill or stalk, which rose and fell in a guide. Of these valves, the second was considered the best, inasmuch as it had the largest water-way (some portion of which was direct), and it was free from some minor objections, to which the leathern-jointed clack was liable. This valve was therefore in very common use in mine pumps, where the area of the pump and the height of the column were not such as to produce any serious inconvenience from concussion in closing the valve.

In the second class of valves, the injurious effect of a violent beat was somewhat avoided, by the ingenious expedient of dividing the valve into several rings, or segments. The simplest of this class was the well known "butterfly valve," in which two semicircular parts opened on a central hinge of leather, and the beat was divided into two parts; but as those closed at the same time, the concussion was principally reduced by the fall not being so great. The next valve was composed of several triangular pieces, opening on leathern joints, from the circumference of the valve seating; it had been much used by Captain Reed, of the Mold Mines, Flintshire, and was reported of favourably, by several other mining engineers. It closed with very slight concussion, on account of the area of each part being small, the base of each triangle forming the joint, while the water-way was large, and nearly all direct, admitting the mass of water to pass forward in lines parallel to the sides of the pump. In the other valves of this class, no leather was used, a circumstance which rendered them more applicable to large pumps, where continuous working was of the utmost importance, particularly in the case of deep mines.

The two annular valves shown were invented by Mr. Hosking of the Perran Foundry, and Mr. Jenkyn of the Copper-house Foundry, (Cornwall). The first of these was composed of a series of rings working on a vertical spill, each ring having its seat on the one beneath it; these rings had different areas, and fell in succession through a small space, compared with that which would be requisite, if the valve were in one piece, so that the concussion was much reduced, while the water-way was increased; but the latter being all lateral, it was requisite to have a large valve chamber. The beats of this valve were formed of tin.

Mr. Jenkyn's valve, differed in construction from the one just described, in having the rings connected with each other by shackle-joints, instead of their working on a vertical spill; the mode of forming the beat was also peculiar; it was composed of two thicknesses of leather, between which wedges of wood were driven into a groove, cast for their reception in the rings; these materials were so placed, that the edges of the leather and the end grain of the wood might form the striking surface of the beat, after being turned off in the lathe.

In the third class of valves, which avoided concussion by reducing the horizontal area of the moving parts, were Messrs. Harvey and West's, and Mr. Hosking's double-beat, and Mr. Darlington's cylindrical single-beat valves. The first of these was a modification of the double beat steam valve, so long used in the Cornish engines; the second named was similar in principle, and was only slightly different in construction. They were both good valves, each giving large lateral water-ways, and therefore they required valve chambers of corresponding size, to ensure their perfect action.

Mr. Darlington's cylindrical single-beat valve was contrived for a large set of pumps under his management, at the Alport Mines (Derbyshire). The rising column of this pump was 38 inches diameter and 22 fathoms in height; it was therefore desirable in such a pump to reduce the concussion as much as was consistent with the power of closing the valve in proper time; this was accomplished, by causing a cylinder to rise over a metal-ring-packing in the seating of the valve so much as to give a large lateral water-way under the beat, formed by the bottom of the cylinder. This valve was found to act well, but it required a very large chamber for the water to enter; the reason for adopting one, instead of two beats, was to avoid or lessen the leakage caused by chips getting between either of the beats.

The only valve belonging to the fourth class was that of Messrs. Palmer and Perkins; it consisted of an elliptical disc, moving on an axis placed parallel with, and near to, the minor axis of the ellipse, and closing at a considerable angle against the interior surface of a cylinder. In a valve so constructed, it would be readily perceived that the concussion might be reduced to any extent, by bringing the working axis nearer to the geometric axis of the ellipse; because the force

with which it closed must depend on the difference of area between the upper and lower portions of the disc. It possessed an advantage in the extent and character of its water-way over all the other valves described, nearly the whole of the water-passage being parallel to the sides of the pump. On the other hand it was objected, that the axis would be liable to rapid abrasion, and consequently the valve would become leaky; but Mr. Jordan did not concur in the opinion of that being an insurmountable difficulty, and he hoped that the valve would be tried, under circumstances which would put its merits to a severe test.

Mr. Taylor said, that the subject of valves for pumps had been so ably treated by Mr. Homersham in his paper (which was read before the Institution last session),* and in the discussion upon it, that there remained but little for him to say. He could not, however, allow the model, which had been exhibited by the permission of Sir Henry De la Bêche, to pass without a few remarks.

In Cornwall, after the improvements in steam-engines had made considerable progress, attention was directed to the more perfect construction of the pumps. The plunger was introduced about that period, and the merit of it has been claimed by different parties;† its use was attended with many advantages, and had now become almost universal.

Some of the benefits derived from its substitution, for the common piston or bucket, had no reference to the subject of valves, and therefore need not be mentioned. In one point it was of great importance; for as the size of the water-way of the valves in the bucket, was necessarily limited by the diameter of the working barrel, an arrangement like that of the plunger pump, which permitted both valves to be fixed in seatings, of which the areas might be increased to any convenient extent, became the more desirable; it was therefore extraordinary, that such tardiness had been exhibited, in taking advantage of such an obvious improvement, when the principle had been long known, and the loss of power, consequent on the former system, was admitted. The model, which had been explained by Mr. Jordan, showed how much the attention of engineers had now been directed to the subject.

In the discussion of Mr. Homersham's paper, Mr. Taylor had mentioned the advantage which had resulted, from the extension of the water-way of some large pump-work, by having two suction-pipes, or wind-bores, and thus doubling the passage through the valves.

It appeared important, for all valves that discharged the water laterally, that more space should be provided, round the seatings in which they were placed, and for want of that precaution, some excellent valves had not answered so well as they would otherwise have done. That which was invented by Mr. Darlington, to avoid some inconveniences in the use of the double-beat valves, would have been improved by an enlarged space around it.

As mines increased in depth, and the volume of water became larger; as steam-engines came into use, having a rapid and sudden motion, as compared with that of water-wheels, which were formerly universally employed for pumping, a great inconvenience was felt from the concussion in the columns of the pumps; this was occasioned by the beating of the valves upon their seats, and in pumps, of the diameter needful for draining some of the mines, this evil became very serious. Almost all the improvements in valves were made with that view; the division of the old butterfly valve into segments was an obvious first step; it had succeeded extremely well, and was still not much excelled. The annular valves of Hosking, Jenkyn, Simpson and others, were based on the admitted principle of dividing the falling clacks into several parts, that they should not rise so high, and that they might collapse in succession, and thus avoid concussion.

Harvey and West's double-beat valve partook of that principle, but was stated to have the advantage of presenting a small area, to be acted upon by the pressure of the column of water upon it. Darlington's valve, which was contrived to avoid the inconvenience arising from the leakage, from both the beats of Harvey and West's valve, when any substance obstructed its perfect closing, presented also a small area for the pressure to act upon; but as it discharged the water laterally, it required an increased space around the seating.

The model exhibited a valve, introduced by Messrs. Palmer and Perkins, upon a principle, by which concussion might be considerably reduced, by bringing into action a part of the superincumbent pressure, to check the descent in closing the orifice. This valve had not yet been tried in large pumps; but the opinions of practical men appeared to be in its favour.*

* Vide Minutes of Proceedings, 1843, p. 195.

† The plunger was used by Sir S. Morland, in 1683, for the force-pumps at the Machine de Marly.

* A valve of a very similar construction is described in Belidor's "Architecture Hydraulique," vol. iii., p. 221, as having been introduced by him in 1737, for the improvement of the water-works at the Pont Notre Dame, Paris. The situation of

In the construction of all valves it was of importance not only to attend to the points which had been mentioned, but also to their durability, and their facility of removal and repair. The actual cost of the valves was of little importance, when compared with the labour and hindrance in removing, or changing them, where the influx of water was great. Serious expense and loss of time were frequently occasioned by such stoppages, and the deeper parts of the mines were exposed to obstructions, which were overcome with great difficulty, notwithstanding many ingenious and well-arranged contrivances to render the process of repair easy and expeditious. Very powerful capstans and other means were provided for these emergencies, and as the labour of fifty or sixty men was sometimes required to work these machines, it would be easily conceived how important it was that such operations should occur as seldom as possible, and that the most perfect and durable construction should be aimed at.

Mr. Perkins observed that although, at the first view, a certain degree of resemblance might appear to exist between Belidor's valve and the disc valve of Palmer and Perkins, there existed in reality but little similarity between them. The former was placed horizontally, whether used as a clack or as a bucket; in all cases it required to be adjusted to a seating formed of reversed cones, like the ring of a steam throttle valve; and it was always attached to a packed bucket or piston. Whereas, the latter worked at an inclination of about ⅛th of the diameter of the pump; it was adjusted within the bored pipe without any seating, and it formed a piston without any packing. Its form being that of an oblique section of a solid cylinder, whose diameter was equal to the interior of the working barrel, and the line of its suspension being beyond the diameter, the areas of the two portions of its surface were unequal; consequently there was more pressure on one side of the line of suspension than on the other. By this extra amount of pressure, the disc was turned on its axis, allowing a free passage for the water, parallel with the sides of the pump. The closing of the lower valve on the return stroke was, for this reason, without noise or concussion. It was evident, also, that as packing was not necessary for the disc piston, and as the rubbing surface of its periphery was very small, the friction must be greatly diminished.

Messrs. Bramah and Robinson made an experiment for comparing a pump with a packed bucket and butterfly valves, with one having a disc piston; the diameter of both pumps was 10 inches, with a stroke of 8 inches, a lever of six to one, and a lift of water of 5 feet; it was found that the former required a force equal to 460 lbs., and the latter 196 lbs. to complete a stroke.

As regarded their duration; a disc pump 7 inches diameter with a stroke of 8 inches, and a lift of 40 feet, drawing its water through 600 feet of suction pipe, rising in that length 28 feet vertically, and worked by a steam engine 26 strokes per minute, had been found, after working nearly night and day at the Equitable Gas Works during 15 months without repair, to exhibit but little appearance of wear in the piston, and both it and the clack valve were perfectly tight.

As the subject appeared to interest the Institution, he promised to present on a future occasion a more detailed account of some similar pumps, with the actual results obtained.

Mr. Lowe corroborated the statement of the efficiency and duration of the valve used at the Equitable Gas Works: its friction was necessarily very small; for as it formed at the same time both piston and valve, and, in the return-stroke, from its nearly vertical position in the working barrel, the parts in contact were reduced to the area of the points of the minor axis of the disc, the friction was in proportion to that area. As a seat-valve, he thought it less liable to become defective than any other, as it was scarcely possible for any sand, or other foreign matter, to lodge upon it; and the valves, which he had seen at work, did not show any symptoms of being so affected.

Mr. Farey said, that it was an axiom relative to steam engines, that their action became more perfect as their size increased, but that this could not apply correctly to pump-valves; for as their size had augmented, the difficulties in their construction had been more fully developed. With small valves, it had been considered that the vertical height of the lift of a clack should be one-fourth of the diameter of the barrel; but it was evident that rule could not be adhered to with large valves. Other forms, allowing a free passage for the water, had therefore been resorted to, and with great success, but there was still room for improvement.

He had a high opinion of the valve which had been used originally by Messrs. Boulton and Watt, and which was called, from its form, the "bishop's cap." It consisted of four triangular flaps of leather, hinged on the periphery of the valve, and meeting in the centre. The number of these flaps had been, he believed, increased to six and eight

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the pivot of the valve is described to be at one-twelfth part beyond the line of the geometrical diameter of the pump-barrel.

A diagram of this valve was exhibited to the meeting.

for very large sizes, and they afforded a very free passage for the water.

Much yet remained to be done, in improving the valves of the air-pumps of steam-engines, especially in adapting them to the speed of the engine, so as to avoid the loss of power consequent on drawing or forcing the water through contracted passages.

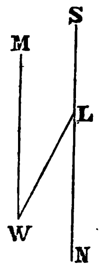
Mr. Jordan was happy to find his opinion of the disc valve corroborated. He had viewed it almost entirely as a clack valve, on which the whole weight of the column of water would rest, and for that purpose he thought it particularly suited. He could not agree in the opinion that chips of wood or other substances would be liable to accumulate near the axis, and render it leaky. He thought, on the contrary, that it would clear itself very easily; and, as the faces or seats were vertical, it was not possible for anything to rest upon them. It had been urged that these valves were difficult of construction, and would scarcely be found tight, under a very heavy column. He conceived, however, that, with modern machinery, there could not be any trouble in making them perfectly accurate, and that the simple addition of a beard of leather fixed on the upper side of the longer portion of the valve, and to the seating at the shorter part, would render the valves quite tight.

Mr. Homersham observed, that any particular form and proportion of a valve, which enabled it to answer well in one situation, was no criterion of its doing the same under other circumstances; for instance, the suction and delivery valves of the pump of a Cornish mine engine required to be differently proportioned; as, in order to follow the speed of the plunger, the water was obliged to move through the former more rapidly than through the latter; for the velocity of the down-stroke of the steam piston of a Cornish engine was chiefly regulated by the portion of the stroke at which the steam was cut off; whereas its velocity in going out was most usually adjusted by varying the period of the pause at the end of the stroke; although it was also somewhat governed by the number of strokes per minute which were required to be made. Therefore, as the plunger always moved quicker in the former than in the latter case, the velocity of the passage of the water through the suction-valve (unless its area was increased), was greater than through the delivery-valve; and the moving part of the valve, against which the water impinged, required to be heavier in the former than in the latter, to insure its closing before the return-stroke of the engine commenced. This had been pointed out in his paper on valves, which was read in the last session; and a rule was given for their relative weights, which should always be in proportion to the velocity of the water passing through them: if this were not attended to, and they were both made of the same weight, the delivery-valve would not open freely, and thus more weight would be required to carry the engine "outside," and the duty would be diminished. He was, therefore, of opinion that every valve required to be adjusted expressly for the situation in which it was placed, and the duty it was required to perform.

ORDNANCE SURVEY—MERIDIAN LINE.

Sir,—I was not aware that the Ordnance surveyors commenced operations by first placing the zero of their splendid three-feet instruments in the meridian, till I saw a list of *bearings* published in a provincial newspaper. It subsequently occurred to me that these arcs being taken from due south, will afford great facility for laying off a meridian line from any church tower, or other object connected with the centre of observations. I will now proceed to give my view of the subject.

Suppose L to be a principal station, and S N its true meridian, and W a church tower connected with the survey. The angle N L W is the bearing of W from the meridian of L, which is found to be 25° 39′ 46″. (I was favoured with this angle through the kindness of a gentleman connected with the survey.) Now



if this angle be reversed at W, in the form of M W L, then will the line W M be parallel to N S, and will become very nearly a meridian line. The meridians of the earth, however, are not parallel lines, and a correction will be required; and the simplest method of doing this

will be by the use of a table in Mr. F. W. Simm's treatise on astronomical and surveying instruments, "showing the length of a second of latitude and of longitude in English feet upon the earth's surface." The difference of longitude between the towers is 3′ 36″ = 216 seconds, and they are both situated between the parallels of 52° 30′ and 53° north latitude. The length of 216 seconds upon the first parallel will be 13363·92 feet, and upon the other parallel 1312·72 feet; let the difference between these two numbers = 151·2 represent the perpendicular of a right-angled triangle, the base of which shall be the distance between the parallels, and equal to 183744 feet; then by the English edition of Hasslar's logarithms, we obtain,

Log. 151·2	2·1795518
Log. 183744	5·2642131
Log. tan. 2′ 50″	6·9153387

And 25° 39′ 46″ + 2′ 50″ = 25° 42′ 36″ equal the angle M W L, so that M W shall be a true meridian line.

It is requisite to observe that when the principal station is to the north, the correction must be subtracted. And the difference of longitude between any two places, as well as the parallels between which they are situated, may be found, near enough for this purpose, from any common map of a county. If it be desirable to transfer the meridian line to any house or garden situated at a distance from the tower, let an apparatus be previously prepared to receive it, which may be done by signal.

The Ordnance maps published some twenty years ago being very deficient in lines of latitude and longitude, the table in Mr. Simm's book is admirably calculated to supply the deficiency. If the latitude and longitude of any principal place upon the map is known, the same for any other place may be readily found by means of the table and a common carpenter's rule.

Yours truly,

J. Loose.

Wolverton, May 4, 1844.

THE TRIP OF THE "WATERMAN, NO. 10," TO OSTEND.

Sir,—Some account of the performance of the *Waterman*, No. 10, will perhaps be interesting to your readers.

She left Woolwich on an excursion, with a party of gentlemen, on Thursday the 25th ult. at thirty-six minutes past 5, A. M., and proceeded down the river, arriving at Margate in four hours fourteen minutes, at which place we were detained by a thick fog, for about an hour. From Margate to Ostend she was five hours twelve minutes, or under weigh from Woolwich to Ostend, nine hours twenty-six minutes, the engines making about forty-four revolutions.

The next morning we left Ostend for Dover, *via* Calais, and were abreast the latter port in three hours thirty minutes, and we lay off, till the steamer *Princess Alice* came out of harbour. We had a fair start, and left her considerably at first, but the *Alice* hoisted her canvass, and gradually, by that extra assistance, gained upon us, and was at the Dover pier head one minute fifty-six seconds before us. It is but fair to state, on the part of "No. 10," that we dropped two fire-bars, through which we were not enabled to blow the steam off for the whole passage.

The time the *Waterman* was coming from Calais to Dover was one hour $47\frac{1}{2}$ minutes.

It was the intention of "No. 10" to return to town on Sunday last, and on the Saturday we went out of harbour for a short cruise, and arrived off Hastings in two hours thirty-three minutes, being $35\frac{1}{2}$ nautical or $40\frac{9}{10}$ statute miles. Off the town we struck abaft on a reef of sunken rocks, and the water flowed in so fast, that we had just time to get the vessel head on to the beach before she filled. On Sunday we succeeded in hauling her well up on the beach, and a *screw patch* having been placed over the rent she will be launched, and proceed to Dover this evening, hence to London the next morning.*

Although at the time of the accident we were three-quarters of a mile off, the blow was distinctly heard on shore, and had she been a timber vessel she must have gone to pieces, but like a tin oil-can, she has only made a dent and a c'ean hole.

I cannot finish without noticing the very great kindness and attention we have received, in the time of trouble, from Lieutenant Mann and his gallant crew, of the Blockade Service. Yours truly,

John Mathew, Jun.

(*Engineer of the boat.*)

Hastings, May 1, 1844.

P.S. "No. 10" was built by Ditchburn and Mare, and engine fitted by Penn and Son. *Forty-five tons and 32 horse power.*

* The vessel has since arrived safely in London.

LOSS OF THE SCREW STEAMER "SEVERN."

(From a correspondent of the *Times*.)

Within these few weeks two new iron steamers, the *Severn* and *Avon*, fitted with the Archimedean screw and high-pressure engines, were started in opposition to the old line of steam packets between Bristol and Newport, South Wales. I regret to state, that on Saturday evening one of them, the *Severn*, was wrecked in the Newport river, just at the moment of her starting on the return voyage to Bristol. When about to start, the *Severn* was lying at her berth near the Newport-bridge, with her bow towards the bridge, her stern being down the river, or in the direction of Bristol. At this time the tide was running up the Newport river very strong, at about seven knots an hour, and of course near to the bridge the current produced by the tide shooting through the arches of the bridge was much stronger. The signal for starting having been given, the captain commenced swinging her round, and cast off the stern chain, depending upon the bow-rope and the power of the engine for bringing her round with her head to the tide, and thus getting her under weigh. At this moment, when the order was given to back her, it was found that the screw would not revolve; the vessel immediately swung round, and, carried with the run of tide, struck with her bow against the sharp wedge-like buttress of the bridge, and recoiling, almost instantly struck with her side against another buttress with such force, that every one on the bridge fully expected to see her turn right over. Boats were instantly put in requisition, and the passengers, upwards of fifty in number, were fortunately all got on shore, but not without very great difficulty, and having to clamber through the mud. The pumps were then rigged, and exertion used to save her, other persons being employed in the mean time in the removal of the luggage, &c., which was safely effected. In about an hour and half she was seen to go down, the captain and crew having only just jumped into some boats previously to her sinking; indeed, they staid by her so long, that the boats in which they were were swamped. The crew were, however, picked up, but by other boats, and rescued from their perilous situation.

By some persons it is asserted that there was no bow-rope out, and that the captain was to blame for letting go the stern-chain before the engine was in action, and also for not having swung her head round in the slack tide. I have, however, made the best inquiries I could into this matter, and have received the following account from one of the gentlemen connected with her engineering department, and who was on board at the time of the accident. He says that on their arrival at Newport on Saturday, it was their intention to put a new screw into her; that on announcing this intention to the captain, he told them that they were so late upon tide, that if they did so he should not have time to swing her round in the slack tide. The intention was then abandoned; but shortly after, while the cargo was being landed, she grounded; upon which the captain, finding that she could not be swung until the next tide, the screw she was then working with was removed, and a new one put in; and this gentleman says, that almost immediately up to the time of the water covering the screw, all was free, and every thing right; for he himself turned round the screw by hand. The steam was then got up, and no danger was apprehended, from the fact of her bow being up the tide, as she had lain so two days before, and had swung round by the power of the engine, notwithstanding her bow-rope parted, having been cut nearly through, designedly, as it is supposed. Upon the orders being given on Saturday evening (he being then in the engine-room), the screw was put in motion; but before it had made a single revolution it stopped, and the vessel drifted up the river. They then looked round the engine-room to discover the cause, but without being able to do so. She then struck forward, but only bent the iron; the after strain was, however, so great, that it shortly became a rent, and her fore compartment instantly filled with water (the vessel being built in water-tight compartments). They still continued to use every exertion in their power, until, the water rushing over her decks, she filled and sank, rolling heavily over. Still no cause could be assigned for the non-action of the screw; but, on the tide leaving her, a chain was discovered firmly twisted round the screw, which had thus caused her destruction. How the chain came there is a complete mystery, as all her mooring-chains have since been examined, and are safe; and the captain and crew say that they had no such chain on deck. The vessel has since rolled over with every tide, and has a rent in her side, from the deck to her keel, large enough for men to walk in and out; so that I am very doubtful whether she will not go entirely to pieces.

Bristol, May 6th.

TUNING-FORKS.

Sir,—In the printed description accompanying the "Standard Tuning Fork," pub-

lished by Mr. J. W. Parker, West Strand, for the especial use of the singing classes, formed on Wilhem's method, under the sanction of the Committee of Council on Education, it is stated, that "the tuning-forks now in use are regulated, not upon any definite principle, but by the imperfect system of *copying*, each one being tuned in (apparent) unison with others. The workman having no test but his *ear* to depend upon, is liable to fall into inaccuracies, the precise amount of which he has no means of determining: hence, the standard itself may vary from time to time." And, again, that "these discrepancies, and the rapid extension of vocal music in England, have led to the opinion, that the present is a favourable time to attempt the formation of a *rigorous standard* of pitch, on an unchanging scientific principle, viz., the number of vibrations per second which produces a given note (C). The great rapidity of these vibrations renders the determination of the number a point of much difficulty; but science furnishes many resources whereby this determination can be made with great nicety." It is then stated, that "the number of vibrations, selected to produce C of the third space, in the treble, is 512; and that each fork is specially tuned to this standard, by a scientific process."

Now, Mr. Editor, as I confess myself somewhat incredulous of this wonderful "scientific process," which presents a test totally independent of the ear, I shall feel much indebted if any of your ingenious correspondents will describe it. There are many persons who look on the whole statement, descriptive of these tuning-forks, as a mere puff; but I can assure you that I have no object in thus troubling you, but a desire to obtain information, and to pay a proper tribute to the merit of this invention, if it really possess any merit.

I am, Mr. Editor, yours, &c.,

W. B.

Belfast, April 20th, 1844.

FRICTION.

From a Report made by a Committee of the Franklin Institute of Pennsylvania appointed to ascertain the amount of friction on the ways for launching the steam frigates *Raritan* and *Princeton*, and which is published at length in the February No. of the Journal of the Institute, we extract the following results:—

"Morin's experiments upon the sliding of plane surfaces of wood upon wood, with coatings of tallow, gave an average co-efficient of $\frac{1}{13 \cdot 7}$, and when the surfaces moved from rest, of $\frac{1}{6 \cdot 2}$.

"The greatest value of the co-efficient of friction found by the Committee is $\frac{1}{15 \cdot 2}$; the average of the two experiments upon the *Rariton* and *Princeton* is $\frac{1}{29 \cdot 8}$. All the errors, if any exist, in the experiments of the Committee, would tend to make the co-efficient appear greater than it is, and yet it is less than one half the average determined by the experiments of Morin."

The thickness of the coating of grease in these cases is stated to have been one-fourth of an inch.

ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

JOHN BAPTIST SOLDI, OF WINDSOR-PLACE, SOUTHWARK BRIDGE-ROAD, SURREY, *for improvements in apparatus for measuring person's heads, and for fitting and retaining hats, caps, and bonnets, according to such measure.* Patent dated Oct. 5, 1843; Specification enrolled April 5, 1844. (A Communication.)

The peculiarity of this apparatus consists in the use of sliding radiating pieces moving in a suitable frame, so that the inner ends of the pieces may come in contact with the varying curvature of the head, and then be set fast in the frame. The apparatus is composed of two parts, an outer and an inner. The outer apparatus consists of two discs or plates, placed one over the other, leaving a space between them of the size of the thickness of the sliding pieces, which have each a longitudinal slot or groove, by which they slide upon a fixed corresponding tongue formed on the lower plate opposite each groove. When this apparatus is applied to the head, the ends of the sliding pieces are brought in contact with the head by an elastic spring, which acts upon all of them at the same time; and when in this position they are fixed by screws. The inner ends of the sliding pieces give the exact form of the contour of the head, but it is farther necessary to obtain this contour upon an external surface. For this purpose the inner or smaller apparatus is arranged so as to reproduce the exact form obtained by the outer one. It is constructed and works in a similar manner to the outer one; and by withdrawing it from the latter, it presents the exact inner contour of the outer apparatus, or, in other words, of the head.

JOHN COLLARD DRAKE, OF ELM TREE ROAD, SAINT JOHN'S WOOD, LAND SURVEYOR, *for improvements in lining walls of*

houses. Patent dated, August 22, 1843; Specification enrolled, February 22, 1844.

These improvements consist in covering walls with a lining of cotton or other cloth, coated on the back with a solution of caoutchouc. Where the walls have plain surfaces, the cloth is applied to them before the coating of caoutchouc is dry, and is retained in its place by means of wooden stretchers along the edges of the cloth, while the central parts of it are being rubbed down. When the walls are panelled, styles or battens are to be formed by mixtures of sand or cement. The panels are then to be first covered over with the cloth as before described, and afterwards the styles or battens, by which means a good finish will be given to the joinings; but instead of first coating the cloth with varnish previous to applying it to the styles or battens, the patentee puts a coat of varnish upon the latter, and then rubs on the cloth in such a manner that the cloth may come in contact with, and adhere to, the various parts, as the members of mouldings, &c.

James Overend, of Liverpool, Gentleman, *for improvements in printing fabrics with metallic matters, and finishing silks and other fabrics.* Patent sealed, July 15, 1843; Specification enrolled, January 15, 1844.

These improvements consist, *first*, in a mode of preparing materials for printing on fabrics to be afterwards covered with metallic powder; and *second*, in a mode of finishing silks and other fabrics.

1. The materials used, and the method of combining them for printing on cotton fabrics are as follows:—One part of white lead, $\frac{1}{8}$th part of magnesia, $\frac{1}{84}$th of litharge, and $\frac{1}{18}$th of sugar of lead, are mixed with a gallon of clarified linseed oil, and reduced into a pasty state; to this mixture is added 1 gallon of gold size; the whole is then boiled, adding to it $\frac{1}{18}$th of yellow wax, and $\frac{1}{28}$th of dissolved gum. When the mixture is taken from the fire it is passed through a sieve. The colour thus produced is fit for use, and is employed in the ordinary manner of block and other printing. When the fabric is printed, and as it is drawn off from the block, the powder is sifted on to the colour from a sieve. The fabric is then removed to a room heated by steam to dry; when dry it is well brushed, placed on a hot cylinder, and subjected to pressure, to give the metal a bright appearance.

2. The fabric is next submitted to the vapour of sulphur. The fabric is rolled on a roller, damped, and passed through a chamber in which sulphur is being burnt, then passed over cylinders (the printed side being downwards), so that the vapour of the sulphur acts on the metallic particles used. The fabric is then dried by passing over rollers heated by steam, and is ready to be calendered.

Jonathan Saunders, of Soho Hill, Birmingham, Gentleman, *for improvements in the manufacture of tyres of railway and other wheels, and in the manufacture of railway and other axles.* Patent dated October 5, 1843; Specification enrolled, April 5, 1844.

The improvements in the manufacture of tyres are thus briefly described:—Steel is piled with iron, and this pile, being heated to a welding heat, is passed under the tilt hammer, and formed into a bloom. It is then passed between grooved rollers, and formed into a bar suitable for a railway or other wheel, in the same manner as when iron only is used.

The second part of the title, embraced by the words "and in the manufacture of railway and other axles," has been disclaimed.

Richard Tanion Nevill, of Llangennech, Carmarthen, Esq., *for an improved method of separating certain metals when in certain states of combination.* Patent dated October 12, 1843; enrolled April 12, 1844.

The "certain metals" which the patentee proposes to separate, are—1st, Silver from copper, when combined in the state of argentiferous copper, by forming a new combination of the silver with lead; and, 2nd, the silver from its temporary combination with the lead. His "improved method" of proceeding is as follows:—A cast-iron vessel adapted for holding metal in a molten state is furnished with a perforated false bottom, or plate, having handles of sufficient length projecting upwards, by which it may be let down or lifted out as required. The argentiferous copper is put into this vessel and mixed with such a quantity of lead as will combine with and take up all the silver contained in the mass, silver having a greater affinity for the lead than copper. When heat is applied, the silver and lead become first melted and collected at the bottom of the vessel beneath the false bottom, while the copper, which requires a higher degree of temperature to reduce, remains at top, but still mixed with small portions of silver, as also of lead. The coppery mass is then removed by lifting up the false bottom, and the remaining particles of silver and lead are separated from it by the following process. It is broken up into small pieces and put along with a quantity of charcoal into a retort, which is then placed in a furnace in a sloping position. The aperture at the top of the retort,

through which the metal and charcoal were introduced, is closed to prevent any access of atmospheric air, but at the bottom end there is another aperture left open for the silver and lead to flow through as soon as they become in a state of fusion, when, as before, the copper is left behind. The silver is finally separated from the lead with which it has been combined, in both cases, by the ordinary process of cupellation.

THOMAS MORTON JONES, of BIRMINGHAM, MERCHANT, *for improvements in heating liquids and other aeriform bodies.* Patent dated October 18, 1843; enrolled, April 18, 1844.

These improvements consist—*first*, in a peculiar arrangement of furnace for heating liquids, &c.; and, *secondly*, in the introduction of vessels called "preservers" into boilers, stills, and pots. The furnace appears from the description and accompanying drawings to consist of a fire-place and two upright shafts connected at bottom by a horizontal flue, in which the more immediate action of the fire takes place. One shaft is for the double purpose of introducing fuel and atmospheric air to support combustion; the other is for the escape of the products of combustion. Nothing is said as to the relative heights of these shafts. The "preservers" are certain hollow vessels, which may, it is said, be either cylindrical, pyramidal, or of any other form, which are placed in an inverted position upon, but not in actual contact with, the bottom of the boiler, still, &c., being kept separate by means of small trivet-like projections from the mouths of the former. A part of the steam generated is forced downwards and underneath these preservers, and by this means, according to the patentee, any deposition of sediment is effectually prevented.

JAMES GRAHAM, OF WAPPING, MIDDLESEX, *for improvements in the construction of pots or vessels, and furnaces used in the manufacture of zink, and in other manufactures, and also improvements in the treatment of the ores of zink, in the process of manufacturing zink.* Patent dated October 18, 1843; specification enrolled, April 18, 1844.

1. The *improvement in the construction of pots and vessels:* The mould for the external surface is composed of a number of staves bound together with hoops, which, instead of being riveted together at the two ends are joined by screws, whereby they are readily slackened to allow the staves to be withdrawn when the vessel has been formed inside. This mould is dropped upon a core placed in an upright position, which regulates the internal form and thickness of the pot or other vessel; the core being secured at the base by means of stays, leaving an open space all round, into which the composition for the formation of the pot is rammed by a tool made for the purpose. In the top of the pot, as thus moulded, but which subsequently becomes the bottom, there is an aperture left which serves to receive a pipe to convey off the metal into the receivers in the manner next described.

2. The *improvements in furnaces:* Each furnace consists of an arched oven, in which a number of the pots or crucibles before described are set; the flues being so arranged, that the action of the fire may come into play all round their external surfaces. Every pot has a pipe perforated throughout its whole length with small holes, inserted into the hole in the bottom of the same, and standing up on the inside to nearly the same height with the sides; through these small holes the vapour of the metal, as it is driven off by the heat, escapes, and is conveyed downwards by means of another pipe attached to the bottom of the pot on the outside, into receivers placed in a chamber formed below the furnace, where it is collected as condensed. The vapour cannot ascend as the pots are furnished with lids, which are securely luted on after the charge has been put in.

3. *The improvements in the treatment of the ores of zink.* The products arising from the distillation of the ores of zink are retained by another set of pipes leading from the bottom of the pots. When blende is distilled, the sulphuric acid is collected in chambers, such as are commonly used in the manufacture of that acid; and when calamine is being reduced, the carbonic-acid gas may be collected for any of the purposes to which it is applied.

GEORGE EDWARD MYLNE, OF ALBION-TERRACE, CANONBURY-SQUARE, ISLINGTON, WATCHMAKER, *for improvements in the construction of watches.* Patent dated, October 21, 1843; Specification enrolled, April 21, 1844.

The object of the improvements which form the subject of this patent is to enable watches having vertical movements, to be made much thinner and flatter than usual. This is effected chiefly by "inverting the fusee," that is to say, cutting it the reverse way. The pillar plate is also made with recesses, which are turned out to receive the end of the barrel containing the fuzee, spring, &c. The patentee, however, confines himself in his claim to the "inverted fusee."

WATER-WHEELS.

Smeaton concluded that the overshot water-wheel realized but *sixty-six per cent.* of the theoretical power of the water. The Franklin Institute has shown that, when accurately constructed, "*eighty-four per cent. of the power expended may be relied on for the effect.*"

Smeaton also concluded from his experiments that "the best velocity (for an overshot wheel) is a little more than three feet" at the skirt—though, singularly enough, he used a much higher speed in his practice, and yet never formally corrected the statements he had made before the Royal Society. The Franklin Institute has shown, that "the best velocity" ranges from "*four and a half to six and an eighth, and probably even to seven and a half feet per second.*"—*The Franklin Journal.*

ATMOSPHERIC ENGINES: THE "SAPPHIRE."

Sir,—Your correspondent "Curve," in his reply to the queries of a Steam-boat Proprietor, has pointed out the disadvantages of several varieties of steam-engines constructed on Watt's principles, in comparison with the atmospheric engines of the *Sapphire*, and has remarked, that the economy of Boulton and Watt's engines does not depend on the use of the cylinder cover, but on the employment of the mode patented by Watt of condensation in a separate vessel. Has not Watt's condenser been applied to the open topped cylinders of the "Sapphire," and should not such engines be termed "Watt's Atmospheric," to distinguish them from Newcomen's, or the old atmospheric, in which condensation was effected in the working cylinder?

The views of your correspondent respecting the friction of these engines seem liable to objection, and it would perhaps be safer, in the absence of good practical data, to assume friction as proportional rather to the power exerted, than to the area of rubbing surface alone. Possibly low steam may require its packing to be less tight in a higher ratio than the increase of area for equal power; if the differences are appreciable, the chances seem to me to be in favour of low steam.

The escape of heat, in the case of an open-topped cylinder, is an obvious defect, both as a direct source of waste, and as producing an injurious effect. I should be obliged for information on this point:—Whether it has not been overrated in theory? And whether, in practice, the heat of the engine-room is much higher than usual in the *Sapphire?*

The common opinion referred to in the queries, that "atmospheric engines must be larger, and consequently heavier, than engines of equal nominal power on the usual plan, besides being less economical in working than the double-acting engines of Mr. Watt," must be derived from tradition, as until the *Sapphire's* performances were before the world, no data for opinions, I apprehend, existed. Perhaps the opinion equally prevalent of the necessity of using only low steam in atmospheric engines is based on no better foundation.

It may be asked, Why might not the piston of an atmospheric engine be loaded to from 7lbs. to 15lbs. per square inch? High steam could then be admitted to work either at full pressure or expansively in the cylinder, to drive up the weight against atmospheric pressure, when the down-stroke would be performed by the weight and atmosphere conjointly.

A scheme of this nature seems better adapted for a pumping than a marine engine, and I propose to forward, for subsequent insertion, three modes in which it may be carried out in Watts's atmospheric engine. The success of the *Sapphire's* engines have pointed out a course that could have been adopted by Watt, in the introduction of his steam engine improvements, by means of which the early commercial difficulties of the firm might perhaps have been avoided. The reasons against this course, I apprehend, have been recorded by Smeaton; since that period atmospheric engines have been neglected. Their real position in the scale of merit arising from the economy of their construction, and their probable greater durability, is a subject of interest to many parties. The present ideas of atmospheric engines refer to Newcomen's engine alone; but the present question is between Watt's atmospheric and Watt's steam-pressure engines, and the different conditions best suited for each variety.

I remain, yours faithfully,

S.

May 6, 1844.

COWAN'S GAS METER.

Sir,—When looking over the pages of No. 1071 of your Magazine for February 17, I found on page 77, diagrams of Mr. Cowan's improved gas-meter drum, and on the next page a description of the same, in which it is stated, that gas is measured by this drum,

with as much precision as spirits are by the standard measure.

Now, Sir, had I not met with this, I should, in all probability, never have informed you that I made a drum on this principle near five years ago, and had I not known that, even with this improvement, it was imperfect, it would, in all probability, have been before the public at least four years ago. In the common drum there is a certain amount of error in each revolution, which is caused by increasing or decreasing the quantity of water above or below the proper standard. But this error is brought about in two ways, or in two parts of the drum, namely, partly by increasing or decreasing the capacity of the gas-chamber in the body of the drum, and partly by increasing or decreasing the capacity of that part of the outlet which is above the surface of the water when the chamber is closed by the water at the inlet side.

The improvement of Mr. Cowan has the effect of keeping the capacity of the chamber in the body of the drum constant, but the inlet and outlet are altered by the variations of the water as in the common drum; for if the water be lowered half an inch below the proper line, the drum must be turned half an inch upon its axis before the inlet can be closed, which will make an inch difference in the outlet. Now, this will make at least an error of four cubic inches of gas for each revolution of the drum.

I am, Sir, yours, &c.

J. Chetwin.

Preston, April 17, 1844.

NOTES AND NOTICES.

The "City of London Steamer."—On the 18th ult., a magnificent iron steamer, to which this name has been given, was launched from the new building-yard of Mr. Robert Napier, at Govan, near Glasgow. She belongs to the rich and enterprising Aberdeen Steam Packet Company, and it is intended that she should ply between that prosperous city and London. She measures, from stem to stern, upwards of 230 feet; breadth of beam, 31 feet; depth of hold, 20 feet; estimated burthen, 1100 tons.

Hungerford Suspension-bridge.—Casual spectators, unacquainted with the art of building suspension-bridges, when they only observe two large masses of masonry erected about 100 yards from each bank of the Thames, with no communication either from the shore or with each other, can little imagine that the structure is so near its completion, that during the present summer the public will be enabled to cross from Hungerford-market to the Belvidere-road, Lambeth, for the small toll of *one farthing* each. To the curious this bridge is worth notice, as being the only one in the metropolis dedicated to foot passengers alone, and erected on the principle of suspension. The entire length of the bridge suspended on chains will be 1,342 feet 6 inches—that is, the centre span or arch, 676 feet 6 inches; those on the side 333 feet each. The width within the chains will be 14 feet, and a clear pathway of 13 feet; the height of the flooring above high water (Trinity standard), in the centre 31 feet 6 inches, at each pier 28 feet 6 inches, and at each abutment 22 feet 6 inches; the height of each pier above the flooring 55 feet 3 inches; the number of main plates which form the chain is 2,500, about 24 feet each in length. The total weight of iron is between 700 and 800 tons, and the estimated cost, including the approaches, is 110,000*l.* It will be seen that its centre span alone is nearly 100 feet greater than the entire of the deservedly celebrated Menai-bridge, which is 579 feet 10 inches. It is likewise 274 feet greater than the centre span of Hammersmith-bridge, which is 402 feet 3 inches; and above three times as great as the centre arch of Southwark-bridge, at present the largest in London. Indeed, with the exception of the wire bridge at Fribourg, in Switzerland, which is 870 feet, it will be by far the largest in existence.—*Mining Journal.*

Glass Milk Pans.—Captain Stanley Carr, of Tüsehenbeck, near Lubeck, has transmitted to the Royal Agricultural Society of England, a glass milk pan, employed successfully in his German dairy. From the memoir which accompanies the glass pan, it appears to be everything that can be desired in a dairy, more easily cleaned than wood, and in Germany cheaper than copper tinned, or cast iron enamelled; but the excise on glass renders their use in this country quite out of the question. The specimen sent by Captain Carr, is 16 inches broad at the top, and 12 inches at the bottom; the glass dark bottle green, perfectly smooth, and about one-eighth of an inch thick, and provided with a rounded rim, which makes it easy to retain a safe hold of them when full. It contains eight quarts, but it is not usual to pour in more than six. These pans cost in Germany eightpence each. It has been ascertained from Mr. Apsley Pellatt, of the Falcon Glass Works, that glass milk pans, of the size and shape of the specimen, but of white flint glass, (why white?) could not be made for less than 7*s.* 6*d.* Another instance this of the baneful result of the duties of restrictions on glass, which have the direct effect of repressing improvements and encouraging fraud. It is a well-known fact, that there is scarcely a manufactory in England, under the control of the Excise, which could be successfully carried on without a greater or less evasion of the laws.

Sale of Iron Steam-boats.—On Wednesday, the 3rd ult., the *Locomotive*, 41 9-10ths tons register, built in 1842, by Messrs. Ditchburn and Mare, with water-tight bulkheads, fitted with a pair of engines equal to 25-horses power, length 104 feet 6 inches, beam 11 feet 4 inches, drawing about 26 inches, was sold by auction for 690*l.* On the same day was sold the iron steam-boat *Prince Albert*, 290 tons, (o.m.,) built in 1842; she is propelled by two engines of 30-horses power, upon an improved construction, by Messrs. Braithwaite, Milner and Co., with tubular boilers; the saloons of this beautiful vessel were fitted up in June last, with great taste and at considerable expense; length between perpendiculars, 155 feet, beam 19 feet 6 inches, depth 10 feet, saloons 36 feet each, ladies' cabin 16 feet, engine-room 26 feet 6 inches, draws 4 feet 9 inches with her fuel on board. The biddings, which commenced at 3,000*l.*, were very spirited, and the hammer ultimately fell at 3,750*l.*

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MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1084.] SATURDAY, MAY 18, 1844. [Price 3*d.*

Edited by J. C. Robertson, No. 166, Fleet-street.

MERRYWEATHER'S CABINET FIRE-ENGINE.

Fig. 1

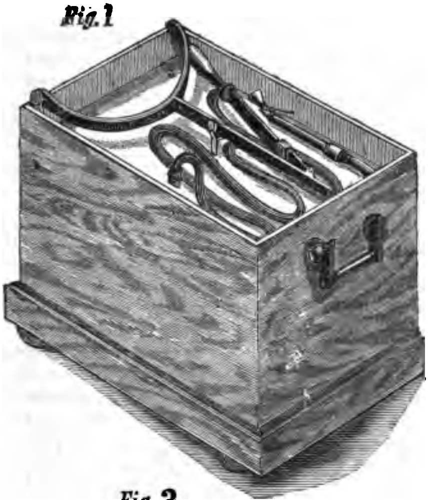
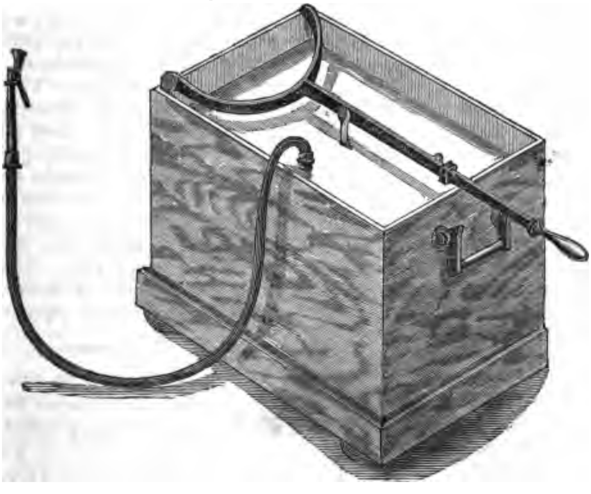


Fig. 2



MERRYWEATHER'S CABINET FIRE-ENGINE.

(Registered under the Act for the protection of Articles of Utility.)

NOTWITHSTANDING the protective forms which fire-engines have been made to assume since their invention, two centuries ago, the appearance of the *Cabinet Fire-engine* furnishes proof that variety is not yet exhausted. It has long been a custom to provide "the stately homes of England" with engines for preventing the spread of fire, and the advantage of such a provision has on many occasions been strikingly shown. The entrance halls of many mansions are adorned with unique specimens of fire-engines of the best construction and appointment, while in numerous instances the out-houses are made the depositories of fire-engines of a less ornamental character. The forms which these machines have hitherto assumed, have greatly limited, and in the majority of instances precluded their admission, to the more vital parts of buildings, or, when so admitted, have led to their being stowed away out of sight, and consequently out of mind, in the hour of need.

The idea of conspicuously placing a properly appointed fire-engine in the drawing-room, the bed-chamber, or the boudoir, has rarely been entertained; and yet, on how many occasions would such an auxiliary, so located, have been invaluable?

The truth is, that the visible mechanism of a fire-engine, with its handles, pipes and buckets, in domestic apartments, is too apt to engender uncomfortable feelings, and to give rise to unfortunate associations; its room has therefore been generally preferred to its company. The present engine, by one of the first makers of the day, was produced at the request of his Grace the Duke of Norfolk, and is certainly the most elegant, as well as the most compact and efficient ever constructed. In addition to more powerful aids located externally, the interior of his Grace's seat, Arundel Castle, is protected by three of these *Cabinet Fire-engines.*

The engine is enclosed within a neat mahogany case-stand, mounted on four strong castors, with a handle at each end; and is kept constantly charged with water in readiness for instant application. In the event of a fire breaking out, the top cover of the case is lifted off, which displays to view the pump handle folded back, and the branch-pipe affixed to the end of a length of leathern hose which lies coiled upon the shelf of the cistern, as shown in fig. 1. Fig. 3 exhibits the working handle straightened, and the leathern hose extended ready for action. The works of this engine are upon the patent principle, with metallic valves, &c. It is capable of delivering water in a continuous jet upwards of 50 feet high, at the rate of ten gallons and upwards per minute. The branch-pipe is furnished with Mr. Baddeley's *Fire-engine spreader*, (a previously registered invention,) which affords the means of covering the whole surface of an apartment, and of extinguishing every particle of fire, with a very small quantity of water: thus limiting the damage done by the two antagonist elements, to the smallest possible amount. In some cases the cover of the engine contains a domestic fire-escape which adds much to its completeness. Whether this engine is considered with reference to the elegance of its appearance, its readiness for application, economy of power, or the perfection of its equipment, it may be regarded as the *ne plus ultra* of modern fire-extinguishing machinery. When got up in a plainer style, this engine supplies what has long been a desideratum, viz., a machine superior in power to the ordinary garden syringes, and more moderate in cost than the usual fire-engines. There are numberless persons who are sensible that the former are unequal to their requirements, but are unable or unwilling to incur the outlay necessary to obtain the latter; to such persons the *Cabinet Fire-engine* strongly commends itself, affording, as it does, at a small cost, the maximum effect of a man's power, combined with great compactness of form, and an unusual completeness of equipment. B.

THE CAMPHINE LAMPS.

Sir,—In your Number 1078 there is a letter from a correspondent, under the signature of "Z. Z.," in which he remarks, that camphine and rectified spirits of turpentine are identical. In stating this he is perfectly correct. Mr. English himself only claims, as you observe in a

note, his particular process of rectifying the spirit of turpentine: to this process the patent is limited, but whether it is an invention of Mr. E.'s is rather doubtful. Camphine has long been in use in the United States, and is the principal article there used in illuminating shops, public buildings, &c. Soon after the alteration in the import duties, Mr. English, as well as other parties, turned their attention to turpentine, and I have no doubt, that it will now, from its very low price —about 3*s*. per gallon—become one of the principal commodities used in illumination. I have rectified several samples of turpentine obtained from the manufacturers, and I find that there is but little difference in the quality of them. Various means have been used for the purpose of rectifying and depriving it of its oxygen—of which it contains in general about 8 per cent. It has at different times been brought forward in England as a material well adapted for lighthouses, and in fact, was tried and approved of by the surveyor to the Liverpool Lighthouses (Lieutenant Lord). The then inventor, being short of funds, could not carry the business on, or find any one to assist him. The surveyor having no regular supply furnished to him was obliged to take the camphine lamps out and replace them with the old ones for burning sperm oil. A person of the name of Spratt, residing at Cork, had a patent for, or at least sold rectified turpentine under the name of patent spirit. This he first brought before the public about 1835, and sold in his own neighbourhood a considerable quantity. The price he charged, I believe, was about 5*s*. to 6*s*. per gallon. His successor now sells at a reduction of 2*s*. to 3*s*. A variety of lamps have been used for burning, but in none have I seen the combustion so complete as in Mr. Young's "Vesta." Though this is only a modification of an American lamp, it is superior from having a non-conducting material interposed between the light and the magazine, and from being also manufactured of better materials, and finished in a workmanlike and elegant manner. The button for deflagration, placed in the narrow part of Mr. Young's lamp, is immovable; in the American it is regulated by a screw. Mr. English, I believe, went to New York previous to taking out his patent. I have been told also that he has had some of the American manufacturers of camphine at his distillery. Several parties now prepare the article, and I believe all prepare it quite as well as Mr. English. It must be borne in mind, that the manufacture of such an inflammable material is attended with great danger. I would also give the consumers a warning on this point, for notwithstanding Mr. Young's ingenious lamp removes much of the danger, still it must be handled with great care, and must on no account be brought near to any flame. There can be no doubt about its being, as Dr. Ure says, (No. 1080, *Mech.Mag.*) the cheapest of all lights; if anything, the cost is less than the sum which he states.

The term *Camphine* was first given to pure turpentine by the French philosophers. M. Dumas, I believe, originated it.

A MECHANIC.

Liverpool, May 9, 1844.

ON SOUND—EVIDENCE THAT IT CONSISTS IN THE MOTION OR UNDULATION OF AN IMPONDERABLE MEDIUM, AND NOT OF AIR. BY HORATIO PRATER, ESQ.

"A bell rung under the exhausted receiver of an air-pump is inaudible, which shows that the atmosphere is really the medium of sound."—SOMERVILLE ON THE CONNEXION OF THE PHYSICAL SCIENCES. (p. 146.)

Although recent physiological researches have induced me to question whether the received theory of sound be correct, I have nothing to object to the above passage of the learned writer, *taken in an isolated sense.* I say, taken in an isolated sense, because it is obvious that the author, like natural philosophers in general of the present day, believes that the air is the medium of sound, because it is susceptible of being thrown into *undulations;* and that it is by such undulations that sound is communicated. Hence, soon after the above passage, we have the following, "The vibration of the particles of air which produce sound," &c. &c., and to the same effect, to the end of the whole of the sections on Sound.

Now I have to inquire if sound be occasioned by the undulations of the air, why it is that we can hear the voices of people in a room above or below us *when all the doors are closed?* I can, while writing this, hear the servants talking in the kitchen *below* me, though of course I am unable to tell what they say,

yet both the door that leads from them, as well as my own doors, are closed, and all the windows also. Now of course the undulations of *air* cannot penetrate the floor (at least as far as we at present know): and supposing the air itself to get through the crevices of the doors or windows, still it certainly cannot reach me in the form of regular *undulations*,* for "each undulation of the air causing sound can only be transmitted straight forwards," says Mrs. S. (p. 148.) I must, therefore, greatly doubt as to the truth of the *undulatory* hypothesis; though from the air-pump experiment I freely admit that *air, in some way or another*, is the medium of sound—is, in short, a conductor.

Besides, when I agitate the air against my ear, I produce undulations in it, yet no sound is audible. However, this experiment is as unfavourable to sound consisting of the undulations of ether. It is only instanced to show that *if* sound arise from undulations at all, it must be from those *sui generis*.

How then, if not by receiving and imparting undulations, is the air necessary to sound? For that it is so in some cases, the air-pump experiment shows.

Without professing to answer this question decisively, I may observe that it may possibly be necessary to sound, by putting some elastic, imponderable, medium in motion—a medium that is able to penetrate all matter, the densest as well as the rarest, that conducts sound. As the undulations of this are presumed to be able to penetrate the floor with facility, on this view we get, at all events, nearer to an understanding why I can hear the sounds now going on below me. We must, however, suppose that the presence of air is necessary to put this imponderable medium in motion, or else why should we not hear a bell rung in vacuo? As this is the case, we infer the bell itself cannot put this medium in motion without the presence and assistance of the air. Hence no sound is communicated to the external air, and consequently none to our auditory nerves. That sound arises from the undulations of the *air*, is almost controverted by the well-known fact of the Indians who put their ear to the *earth* when they want to hear noises far off in the desert. "Lieutenant Foster, too, (*opus cit*, p. 155,) was able to carry on a conversation across Port Bowen harbour, when frozen, a distance of a mile and a half." Many other facts favour the opinion that, supposing the ether presumed to exist being the medium of sound, solids are affected more sensibly by its motion through them than the air is, and consequently the reason why such solids are better conductors of sound.* How much better conductors solids are of sound than the air is shown by putting a small watch in the mouth, the ticking of which is scarcely audible till it touches the teeth. However, if we merely endow this ether with the ordinary properties of highly elastic fluids, it seems still somewhat difficult for us to see how, by particular *undulations* striking the ear, we are made sensible of the infinite *variety* of sounds pervading nature. As it is scarcely possible to conceive that a mere difference in *extent or quickness of undulations* can account for our faculty of hearing such an *immense variety* of sounds,† I must suggest that the ether herein presumed to be the *real* medium of hearing when set in motion by the air—the ostensible medium—is probably endowed with some other properties, which I do not propose to consider further in the present communication; and indeed as philosophers in general may consider the queries just put as going beyond the limits of physical science, I the more readily pass them by here, as probably the best reason we can give on this subject is, that the Author of nature willed that such motions

* I suppose it would be attributed by philosophers in general to "sympathetic vibration," beautiful experiments on which subject are given by Mrs. S., at p. 169. The air then striking against the ceiling below me, throws this ceiling into vibration, which, communicating a like motion to the air in my room, causes me to hear the sounds below. But surely the vibration of a *fixed* ceiling, from two persons being *in ordinary conversation*, is next to impossible. I therefore leave the reader to decide whether this view is so satisfactory as the new one which is the subject of the text.

* This Mrs. S. admits, and says, "Sound passes through iron, glass, and some kinds of wood, at the rate of 18,530 feet in a second;" "the velocity is proportioned to the hardness," (p. 154.) Hence, as there are better conductors of sound than the atmosphere, this is clearly not with consistency called the medium of sound, and is all in favour of its never being more than INDIRECTLY concerned in that phenomenon.

† Besides, still less will it render clear how we can hear *two different* sounds, from different directions, at the same time, which nevertheless seems possible, for I can do so at this moment, as I conceive.

should always be followed by such sensations. Neither shall I now inquire whether the imponderable ether—the presumed medium of sound—is the same as that supposed by philosophers who support the undulatory hypothesis, to be the medium of light and heat.

I may, before concluding, propose the question, viz., How it is that solids are better conductors of sound, if sound depends on the *motion* of the particles of matter? Surely no one will say that the particles (atoms) of solids are more easily thrown into motion than those of fluids? I must, however, admit that the atoms of iron (at all events) are thrown into motion by *violent hammering* or friction, and hence the cause of the crystallization, and consequent fracture from *brittleness*, so to speak, of the axles of locomotives, as late experiments have shown; and this, as far as it goes, seems in favour of the received theory of sound, as it supports the opinion that the atoms of *solids* may be thrown into motion. I do not, however, consider it of much value, for there is in such case much *heat* produced by the friction, which we may reasonably presume to be essential to such change of position of atoms, and consequent crystallization. Besides, it is the only solid known to be susceptible of so singular a change; yet all seem good conductors of sound; and without being in a condition to allow their particles to move, viz., without *being heated by hammering*.* Indeed coldness seems very favourable to the propagation of sound, for Captain Parry was able to hear, as I have been informed, conversation in the ordinary tone of voice a mile distant in some parts of the Polar Seas; and the facts already related with regard to Lieutenant Foster seem also to support the same position.

The great tendency of sound to ascend seems also in favour of an imponderable fluid being the real medium of sound. Humboldt asserts that a dog has been heard to bark by persons in a balloon three miles from the earth. Now the lighter the medium the greater the tendency, we should expect, to propagate an impression upwards, since its own tendency would always be to rise in that direction.*

Finally, since matter is compressible, its particles are not in contact, but are, as Mrs. Somerville, and other authors admit, probably surrounded by an atmosphere of some imponderable fluid—the cause of electricity, or electricity itself. Hence when a solid is struck easily, this imponderable must be thrown into undulation more easily than the solid particles themselves; since we know that electricity is produced by the slightest *contact*, which fact implies that motion has been produced in the ethereal medium. This, I say, is a fact; but we do not seem so sure that the atoms of *matter* are thrown into motion by such slight contact. Indeed when we remember what a very slight contact of solids is *audible*, it seems far more probable that the motion of this all-pervading ether is really the cause of sound, than that the motion of the atoms of matter is so.

* On farther reflection, however, I allow a mobility in the particles of matter, as matter is compressible by hammering, &c. But then, admitting this, I do not see that we have any evidence that atoms can be put in motion by such very slight contact as is adequate to produce sound.

* It seems from this fact that rare air is a good conductor of sound propagated in dense air, although it may not be so when sound is produced in itself.

WADHAM'S ELECTRO-MAGNETIC CLOCK.

Sir,—The science of electricity becomes daily more interesting, and scarcely a week passes in which some new application of its principles is not made, either under the form of electro-magnetism or electrography: and as in both these subjects your pages have lately contained some very interesting announcements and correspondence, it gives me pleasure to offer something to you which may be interesting to your readers.

The enclosed extract from one of the Bath papers describes what I have myself witnessed, and what I believe displays more contrivance and scientific adaptation than any other of the clocks which I have seen.

As soon as I can obtain from the ingenious artist a drawing of his clock, I will with pleasure forward you a copy.

I am, Sir, your very faithful servant,
Z. Z.

May 11, 1844.

New Galvanic Clock.

[From the *Bath and Cheltenham Gazette* of May 1, 1844.]

A galvanic clock, of a novel and very complete character, has just been completed

by Mr. Wadham, of the Abbey Green, for a gentleman in the neighbourhood of this city. It is, we believe, the first and only instrument of the kind which can properly be denominated a *clock*. Professor Wheatstone's "electrical clock" was some time ago described in the *Bath and Cheltenham Gazette*, but that apparatus was rather a *telegraph* of the time kept by *another* clock, than a clock *per se:* its movement, though produced by galvanism, being dependent on an ordinary clock, the latter forming and breaking the metallic circuit, and thus bringing into action the galvanic power. But Mr. Wadham has *accomplished* what, we believe, has only hitherto been *attempted*. Electrical clocks, deriving their whole power from the galvanic current, have indeed been constructed, but they have unfortunately been wanting in one indispensable requisite—they had no pretensions as correct time-keepers. In Mr. Wadham's galvanic clock, admirable workmanship is combined with elegant simplicity of contrivance and effective accomplishment of the object designed.

The battery power is economized probably to the utmost. A small "Smee's battery" appears sufficient to maintain the clock in action for many weeks, a fresh charge of diluted acid being given once in about 14 days. The clock is first put in motion *manually*, by the action of a lever on a coiled spring. It is the office of the galvanic current to continue this motion. This is effected by the electro-magnetism of a piece of soft iron, which, by an ingenious arrangement of a contact-former connected with the escapement of the clock, becomes a powerful magnet for about 1-20th part of a second, but remains inert during the remaining 19-20ths of every second. This arrangement so greatly economizes the battery, that it is really in action but little more than 1 hour in every 24. It awakens its mysterious magnetic power in the soft iron with more than the rapidity of thought; it then reposes for the remainder of each second, gathering power for a fresh impulse. Such is the lightning-like rapidity with which the "armature" advances each tooth of the ratchet-wheel, on which it acts, that the eye can scarcely detect the motion of the wheel—it apparently stands still. The revolution of the ratchet-wheel imparts power to a spring, which not only sustains the original impulse given to the machine, but *accumulates* it. This accumulated power, whilst provision is made for its never exceeding a certain amount, subserves two or three valuable purposes:—the varying power of the battery (provided it supplies enough to maintain the original momentum) does not affect the timekeeping; neither is it of any consequence if the accidental presence of a particle of dust at the contact-former prevent the contact being made regularly every second; and, lastly, the clock is so far *rendered independent of the battery itself*, that it will continue to go correctly for above a minute *after the battery is removed;* thus providing ample time to change the battery or to renovate it by a fresh charge of diluted acid. In short, this beautiful piece of apparatus scarcely leaves anything to be desired in the construction of a galvanic clock.

HUGHES'S IMPROVEMENTS IN ILLUMINATED CLOCKS.

The utility of making the dial-plates of public clocks visible by night as well as day is so manifest, that it must seem at first sight a matter of wonder, that the plan of illuminating them, introduced a few years ago, and which the modern invention of gas lighting renders so easy of accomplishment, has not by this time become more general. Of all the clocks in and about the metropolis, we cannot call to mind more than half a dozen that are thus lighted up; and the proportion is not, we suspect, much greater in other places. The cause of this is sufficiently well explained in the following introductory observations by Mr. H. Hughes to a short account which he has published* of the very useful improvement in this system of illumination, which we have now to bring under the notice of our readers.

"The precise amount of the utility of any particular clock depends upon the number of *Passengers*, and on the number of points from which these can distinctly discern the time on the dial, whether it be by day or by night. If such points are few, in consequence of a confined situation, or opacity and obscurity in the dial itself, the object attained is proportionately limited. Many public clocks are, as to their situation, exposed to teeming thoroughfares of great extent; but from the imperfection in the form of their dials, they are perfectly useless, until they are approached within a very short distance.

All *illuminated* clocks have hitherto been found particularly defective in this respect—you may as well stare at the rising moon, to ascertain the hour of the evening, as at them, if you are 200 yards from them. You look

* Telegraphic Clock: A Mode of Showing Time by attaching Lights or Reflectors to the pinion and the hands of the Clock. By H. Hughes, 16pp., 32mo., Jones, Liverpool.

up and see a light, where there should be a *clock;* and you discover only by the circular form of that light (see fig. 1) that you are not looking at some other garret window. You proceed without the satisfaction you sought, thinking yourself too early or too late, according to the previous impression.

*   *   *   *

"The fact appears to be, that the common clock dial is too much complicated, and too much encumbered, and that a new principle is essential to improvement."

The "new principle" on which Mr. Hughes proceeds is thus clearly enunciated and explained.

"The principle is this:—*The only visible signs necessary consist of three points, to the exclusion of dial, hands, figures, and marks of every description.*

"*At night these points are Lamps—gas burners.* These will bear the same relation to each other as the extremities of the hands hold to each other, and to the centre, on the old system. The point marking the centre will be stationary, and those pointing out the hour and minute, respectively, will revolve round the former; and the situation of these is to be discovered *by the assistance of the perpendicular and horizontal lines,* supposed to be distinctly marked in the mind of every observer above the age of infancy.

"What we want to know is the situation of the *points* of the hands—the HOURS may be known without an index, FOR THEY NEVER MOVE. Now, surely, the things *called* figures are not suitable indices, if any such were required. What can indicate a point itself ought to be a point. A monitor in a charity school might as well be directed to point out the vowels and stops to the pupils *with a gridiron,* as that the point of the clock hand should be indicated by a row of bars such as this, IIIΛ, or XI, or III, &c.

"Another disadvantage, and a great absurdity, is, that the heavy strokes of the initials *lie parallel with the hands,* and being half their length render invisible *the only part of them which ought to be seen.* The whole together is a large *belt,* covered with *confusion,* and forming a rim to a smaller circle, on which are seen *three* stumps, or latches, performing revolutions deserving of better expression.

*   *   *   *

"In the new plan there is *no pretence of a guide besides the centre.* The HOURS require no other index. Every one knows that 12 and 6 are *above* and *below* the centre, and that 3 and 9 are on the *right* and the *left* of the centre. It is also easily remembered that 1 and 2 lie between 12 and 3, &c.

*   *   *   *

"If the reader imagines that there is a difficulty in comprehending this principle, let him place before him a sheet or tablet, and let him write C, which shall stand for the centre of the clock. Next let him write 12; this, of course, he will do exactly over the C. He will then write 6; he need not be told that this should be *under the centre.* He will then write 3 and 9, both of which will lie *horizontally with the centre.* There will now remain two blanks above the horizontal, one of which will have to be filled up with 1 and 2, and the other with 10 and 11. Now, if it will not be known on which side of the 12 the 10 and 11 should be placed, the essayist shall be allowed to count himself one of those who have not sufficient comprehension for the present purpose. If, on the contrary, he finds he can fill the entire circle with its twelve hours, he will have given a demonstration that the dullest subject is competent, not only to *learn,* but to *use at first sight* an exhibition of time on this plan.

The two lines, the vertical and horizontal, before mentioned, have not to be impressed upon the imagination of any—they are already impressed with great distinctness and accuracy. One correct idea besides this is necessary; but it is easily acquired, and habit will immediately secure it without an effort—it is the division of the angle formed by the leading lines, by fixing the two points at equal distances—for instance, the one and two, and seven and eight, as in fig. 2.

Fig. 1.

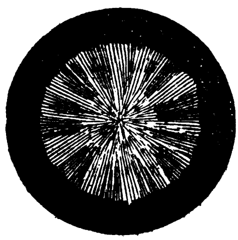


Fig. 2.

When the mind has achieved this, all difficulties will have vanished; and the very *minutes* will be better known than when indicated by the *harrows* and *hurdles* of the old system."

A clock, therefore, constructed and illuminated on the plan proposed by Mr. Hughes would exhibit the appearance represented in fig. 3, (supposing the hour to be 3 o'clock). Or for the sake of greater facility of comprehension, the remaining hours may be indicated by smaller illuminated points, as shown in fig. 4. The latter modification, however,

Fig. 3.

Fig. 4.

though suggested by Mr. Hughes himself, is a departure from his system, and to our minds an unnecessary one, for so palpably do the *three* illuminated points alone, tell their story, that literally, even he who runs may read. The advantages of Mr. Hughes's plan seems to us by no means overstated in the following paragraphs.

"Allowing that on the best of the old illuminated clocks, the time can be told at the distance of two hundred yards, and that on the new it can be distinguished at two *thousand* yards, it follows that, the latter is of *ten times the value* of the former. And if instead of a straight line of street immediately in front, there lies a clear area, to the right and the left, the number of points from which the time on the new clock can be seen is, in comparison to the old, as fifty to one, or five thousand per cent.

"But this is not all: it will easily be perceived that, this principle admits of the possibility of showing the time at the distance of many miles. *Where lights can be distinguished the time can be told, whatever the distance may be.* The idea is conceivable that lights may be so arranged that the hour would be told to the *mariner* at the distance of half-a-dozen leagues, and on any point of a space comprehending five hundred square miles."

The expense of fitting up a public clock on this plan would evidently be much smaller than that of illuminating the entire face. Mr. Hughes calculates that "the quantity of gas consumed will not be a *tithe* of what is required on the old plan." He observes further, that "the apparatus for conveying the gas to the points of the indicators, and the spindle may be applied to the outside of any clock without *even entering the building containing the machinery*;" and in this security from fire, there is doubtless, another great advantage.

Mr. Hughes suggests that his mode of indicating the hours may be also usefully applied to indoor clocks and time-pieces *not illuminated;* on the inefficiency of which, as at present constructed, he makes the following just and forcible observations:—

"There are public rooms with clocks, and there are some without clocks. There would be none without, if it were not for the defective power of the old plan of fully answering the end proposed. There are rooms with two clocks, one at each end, neither of which can be seen from the centre of the room! There are clocks placed on purpose to warn of the approach and arrival of the hour beyond which it is not desirable to detain an assembly of people, but which never *do* inform the parties concerned, because the distance, or the glare of reflected light, in conjunction with the miserable apparatus by which the dial is furnished, prevents it.

"The clock dial in a public room, viewed from more than half the points on the floor, is a mere reflection of a window, and has just as much to do with telling the time as the window it reflects. This reflection is the very thing which ought to be turned to account, and made to assist in the securing,

rather than the preventing, the attainment of your object: and this is what is done in the new plan."

Mr. Hughes proposes, in regard to this class of articles, to make them with gold hands revolving on a black circle, or gold hands revolving on a convex mirror. Either mode would be decidedly superior to the present; but we agree with the author in preferring the latter.

"The light is collected at the three necessary points on the clock, and it is there strengthened and beautified by the silvered mirror, and thence conveys the right idea to all points of the room, telling the time to the shortest sight at a greater distance than any old clock ever told it to the *longest*."

REPORTS AND NOTES OF CASES ON LETTERS PATENT FOR INVENTIONS. BY THOMAS WEBSTER, ESQ., BARRISTER AT LAW, 1844.

The author of the work before us is a remarkable instance of the rapidity with which a man of talent may arrive at eminence, who steadily and perseveringly devotes himself to the cultivation of one branch of study, or the prosecution of one course of useful pursuit. It cannot be much more than six years ago since Mr. Webster made his first appearance at the bar, and still less since he held his first brief in a patent cause; yet he has already the reputation of being our ablest patent lawyer, and is retained on one side or other in almost every case that arises touching the law of patents. The source of this reputation is tobe traced, no doubt, to the two, now well known, works which he has written, one on "the Law and Practice of Patents," and the other on "the Subject Matter of Patents;" but had his ability as a writer not been seconded by still greater ability as a practitioner, he could hardly have made such a start in the profession as he has done. The productions referred to can neither of them be said to be worthy of his present fame; for though it might be difficult to cite any work of an older date which is superior to them, it would be matter of at least equal difficulty, to discover in them, that fulness of knowledge and perfect mastery of the subject which Mr. Webster does now undoubtedly possess.

The collection of cases with which Mr. Webster has now favoured the public, is "intended to comprise the authorities from which the principles and practice of this branch of the law are derived, and to which recourse must be had in determining the various questions which arise in connexion with these subjects." We are not sure that it contains *all* these authorities; but we do not miss any of importance, and can safely recommend the collection, as being, on the whole, the most complete and satisfactory that has yet appeared. The text is illustrated by an abundance of most useful notes, in which Mr. Webster's reasoning and judging powers display themselves to great advantage. We select, by way of specimen, the following instructive remarks on the recent decision of the House of Lords in the case of Neilson *v.* the Househill Company, for the infringement of the hot-blast patent, in which a new trial was ordered on the ground of a misdirection of the judge below, as to the effect of *prior use* on the validity of a patent.

"The judgments in the above case recognize and affirm the general rule of law, that the prior public use of a complete and perfected invention, though abandoned and not in use at the time of the granting of subsequent letters patent for the same invention, will vitiate such letters patent, inasmuch as such prior use negatives the title of the party as the true and first inventor; but the concluding observations of the noble and learned lords throw considerable doubt and uncertainty upon the practical application of the above general rule, since they import that cases may exist of the abandonment of the use of an invention, such as would entitle a subsequent independent inventor to valid letters patent for the same invention, provided the invention had been forgotten and laid aside, and the knowledge thereof so lost as that the invention should come upon the public as an absolutely new discovery. But whence is the evidence to be derived by which such a use would be proved? In the course of the argument the distinction which exists between the issue involved in the words of the proviso of the statute, 'true and first inventor,' and in the words, 'which others at the time of making such letters patent and grant shall not use,' was very much discussed; but the above judgments, except so far as they may be qualified or affected by the additional and concluding observations of their lordships,* are founded

* The observations here referred to are, we presume, the following:—

"Lord Chancellor.—It must not be understood that your lordships, in the judgment you are about to pronounce, have given any decision upon this

on the former words, without regard to the latter, and as if the latter did never exist. For the purpose of presenting the real questions which arise under the issue on the words, 'true and first inventor,' it will be convenient to consider the evidence applicable thereto, which may be divided into the following classes:—1. The specification of a prior patent. 2. Some work printed and published, or in circulation in this country. 3. The existence prior to the date of the patent of a machine or article of manufacture substantially the same as that which is described in, or the subject of the patent, with or without evidence of the actual use of such machines or manufacture.

"1. With respect to the first of these, namely, the specification of a prior patent, that has always been held sufficient of itself to invalidate subsequent letters patent for the invention therein described, without any evidence of user. *Per* Lord *Ellenborough*, C. J., *ante* 86, and in the course of the argument in the principal case by Lord *Campbell*, 'A prior specification, substantially describing the same machine or invention, has always been considered fatal to a patent, without going further, by showing that it has been used.'

"Various reasons have been assigned as the ground of the above rule. It has sometimes been said that knowledge and the means of knowledge are the same thing, and this may well be so in some cases as matter of law, and in the particular case of the specification of letters patent it may be said that the public are bound to take notice of whatever is of the nature of a public record, and as such enrolled in the Court of Chancery. *Ante*, 86, n. *c*. But on the authority of the principal case, the rule may be considered to rest simply on the ground of negativing the title of the party as the true and first inventor, and the grant of letters patent and the enrolment of the specification describing the complete and perfect invention, would appear to be the best evidence to negative the title of a claimant under subsequent letters patent as the true and first inventor. With reference to the distinction so much insisted on in the above judgments, between experiment and invention, complete and perfected, it may be suggested, whether the obtaining letters patent for an invention fully described in the specification, and proved to answer, is not conclusive evidence that the invention was complete and perfected, and did not rest in experiment, speculation, or suggestion.

"2. With respect to the legal effect of the publication in a book—On the principle above referred to, that knowledge, and the means of knowledge on the part of the public, are the same, and that the public has acquired little or nothing by the specification which it did not possess before, it has been generally assumed that the production of a book which was in the hands of the public before the date of the patent, will negative the title of the patentee as the true and first inventor.

"Thus, on the argument of the above case, Lord *Lyndhurst*, L. C.: 'If the machine is published in a book, distinctly and clearly described, corresponding with the description in the specification of the patent, though it has never been actually worked, is not that an answer to the patent? It is continually the practice on trials for patents to read out of printed books, without reference to any thing that has been done.

"Lord *Brougham*: 'It negatives being the true and first inventor, which is as good as negativing the non-user. It must not be a foreign book, but published in England.'

"The important distinction last adverted to was recognised by Lord *Campbell* in a recent case before the Judicial Committee of the Privy Council, on some foreign books being put in to show the state of knowledge on subjects closely connected with the invention for which letters patent were sought to be extended. That noble and learned lord observed, 'that sitting there he should be influenced by what had been published in a foreign journal, but in a court of justice he should require that it should be known in England.'

"The distinction thus made between the legal effect of publication in an English and in a foreign book, would appear to establish this important doctrine, that it is a question for the jury whether such foreign work was known in England at the time the letters patent were granted; or the question would rather appear to be, whether the inventor derived his knowledge from such source, or whether the work was so known that the inventor must be presumed to have derived his knowledge from that source. If this be a question for the jury in any case of publication in a book in the hands of the public, whatever its nature, and however limited its circulation, but which, had the public required it, might have been in exten-

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state of facts, namely, if an invention had been formerly used and abandoned many years ago, and the whole thing had been lost sight of. That is a state of facts not now before us. Therefore it must not be understood that we have pronounced any opinion whatever upon that state of things. It is possible that an invention may have existed fifty years ago, and may have been entirely lost sight of, and not known to the public. What the effect of this state of things might be it is not necessary for us to pronounce upon.

"Lord Brougham.—It becomes like a new discovery."

sive and general circulation, it is not very easy to see on what principle, or why the same question may not be for the jury in any case of publication by any book. From the observations of the learned Chief Justice *Tindal* in several recent cases (*ante* 592, n. *e*, and the cases there referred to), this would appear to be a proper question for the jury.

"If in any case it is a question for the jury, whether a person did actually borrow, or is to be presumed to have borrowed his invention from a published book, or whether the account contained in any published book, was or was not known in England by reason of such published book? but it is not a question for the jury, in the case of an account contained in a specification, that difference must be founded on the fact of the prior grant by letters patent, and that the specification, being matter of record, is a publication of which the public are bound to take notice; whereas the public cannot be presumed to take notice of, or to be acquainted with, all books. The fact of the existence of a specification, whether so published or not, negatives the title of any person subsequently claiming to be the true and first inventor of an invention substantially the same as that described in such specification.

"But whatever may be the peculiar circumstances under which the publication takes place, the account so published, to be of any effect in law as a publication, must, on the authority of the principal case, be an account of a complete and perfected invention, and published as such. If the invention be not described and published as a complete, perfected, and successful invention, but be published as an account of some experiment, or by way of suggestion and speculation, as something which peradventure might succeed, it is not such an account as will vitiate subsequent letters patent. See *per* Lord *Abinger*, C.B., *ante* 534. It would appear to be a test not wholly inapplicable to cases of this nature, to inquire whether what is so published would be the subject of letters patent, because, inasmuch as that which rests only in experiment, suggestion, and speculation, cannot be the subject of letters patent, it would be unreasonable that what could not be the subject matter of letters patent, supposing letters patent granted in respect thereof, should vitiate letters patent properly granted.

"3. The third class of evidence is the production of a machine or article of manufacture with, or without proof of actual user anterior to the date of the patent. On the authority of the above case it would appear that the production of such a machine or article of manufacture, without actual proof as to its use, or any evidence as to whence it originally came, or as to its mode of manufacture, would vitiate subsequent letters patent for such a machine or article of manufacture, as negativing the grantee of such letters patent being the true and first inventor. With reference to this head, two distinct cases may occur—the one in which the machine or article of manufacture so produced shows at once its mode of manufacture—the other in which the machine or article of manufacture does not present any means of knowledge to the public, so as to enable any person to reproduce the same. There may be many various modes of attaining a result, and an article of manufacture may be the subject of various patents. The term 'new manufacture' may be satisfied either by a thing that is made then for the first time, or that is made in a new way then for the first time. An arrangement of material parts, as a simple combination of the elements of machinery, discloses its mode of manufacture to the eye on inspection; but with respect to a paint, or a dye, or a medicine, and many other inventions, a mere inspection of the result attained will convey no information as to the mode of manufacture. The distinction just adverted to relates to the doctrine, 'that knowledge and the means of knowledge are the same;' but independently of this, this last class of cases, depending upon user, differs altogether from the two first-mentioned classes of cases, depending upon publication in such a form as to preserve and communicate the knowledge to the public. The following observations with reference to this question were made in the course of the argument on the principal case.

"Lord *Lyndhurst*, L.C.: 'Look to the words of the statute: "The declaration before mentioned shall not extend to any letters patent and grant of privilege, of the sole working or making of any manner of new manufacture within this realm, to the true and first inventor of such manufacture, which others at the time of making such letters patent and grant shall not use." If the invention is in use at the time that the grant is granted, the man cannot have a patent, although he is the original inventor; if it is not in use, he cannot obtain a patent if he is not the original inventor. He is not called the inventor who has in his closet invented it, but who does not communicate it: the first person who discloses that invention to the public is considered as the inventor. The party must be an inventor, you need not say the inventor, because another may have invented it and concealed it: but in addition to his being an inventor, others must not use the invention at the time of the patent.'

"Lord *Brougham*: 'The statute excludes from a patent the true inventor who shall

have made the invention so public that others at the time of the granting of the patent shall use the invention. The public have lost the consideration for the patent, namely, the specification which is given. The words 'true and first inventor,' and 'which others at the time shall not use,' are cumulative.

"Lord *Lyndhurst*, L.C.: 'He must be the first inventor, and it must not be in use at the time of granting the patent. For the purpose of meeting the case as to the point, that he is the first inventor, evidence may be gone into to show that a person used the invention for a year or two ten years ago, and then ceased to use it. That has nothing to do with the use at the time the letters patent were granted. Admitting that he is the inventor, if the invention is known and used at the time at which the patent is granted, in that case the patent is void; that is the sense in which the words 'used at the time of the grant of the letters patent' are employed.

"Upon the above words of this noble and learned lord, 'known and used at the time,' the question arises as to what is the kind of knowledge and use whereby letters patent will be vitiated.

"Suppose an article of manufacture, an encaustic tile, for instance, or a particular species of painted glass, such as was well known in the middle ages, to have been manufactured at a certain period in this country in secret, or if not in secret that the knowledge of the art was lost, but that such tiles and painted glass were known and in use before the eyes of the public to the present time, and that it was a great desideratum that the art should be discovered, and that some ingenious man discovered a mode whereby tiles and painted glass, apparently the same, could be produced, and published that mode to the world under letters patent, would the knowledge and use of the tiles or painted glass at the time such letters patent were granted vitiate such letters patent, no knowledge or use of the invention as an art existing at the time of the grant? The knowledge of the fact of the existence of an article of manufacture, or the daily use of such an article, cannot, it is conceived, be knowledge and use of the invention within the meaning of the above terms, so as to vitiate subsequent letters patent. If such knowledge of the existence of an article and use of an article convey at once the requisite information as to its mode of manufacture, the case is different from that above supposed, which assumes the absence of that very knowledge which it is the object of the letters patent and specification to communicate and bestow. What has once been given to the public cannot be resumed; the public being in possession of any species of knowledge, there is no consideration for the exclusive privileges granted by subsequent letters patent; there is no fresh knowledge to be communicated to the public through the medium of the specification, to constitute the consideration upon which the letters patent are granted; such knowledge being the price and bargain for the grant, or that which the public get in return for the limited monopoly. It would appear, therefore, on principle and on reason, that the knowledge of an invention which is to vitiate letters patent must be knowledge of the same kind as that above referred to, namely, such knowledge or such means of knowledge, as will teach others to practise the invention.

"A similar ambiguity attaches to the word 'use,' and the question arises, whether the use of an article under the circumstances above mentioned will vitiate subsequent letters patent, granted to a person who introduces the knowledge of the manufacture. In determining this question, regard must be had to the proviso of the statute, which declares that the previous declaration against monopolies shall not extend to any letters patent of the sole working or making of any manner of new manufacture within the realm. The working and making of the article to be produced is the subject of the grant, not the use of that article when produced, and the meaning of those words is well defined by the exposition of the law, as stated in the case of monopolies (*ante* 6), and recently recognised and adopted by the Court of Common Pleas, in the case of *Crane* v. *Price*, in the following terms, 'when any man by his own charge and industry, or by his own wit or invention, doth bring any new trade into the realm, or any engine tending to the furtherance of a trade, that never was used before, and that, for the good of the realm, in such cases the king may grant to him a monopoly patent for some reasonable time, until the subjects may learn the same, in consideration of the good that he doth bring of his invention to the commonwealth—otherwise not.' So that the subject of the grant, according to the old common law, on the authority of this case, is to be a new trade, or an engine tending to the furtherance of an existing trade, provided such trade or such engine had never been used before, whereas, according to the statute, the condition would appear to be limited to the trade or engine being in use at the time of the grant. But then the difficult question arises, if ever in use, after what period, or under what circumstances, is the title of the party as the true and first inventor not to be negatived? The observation of Lord Brougham (cited above) that the latter clause of the statute is cumulative

in effect, places the whole question on the issue of the true and first inventor, independently of the question of publication or prior use. It is, however, established, that these terms are not applicable to the case of a person who has made the invention, and confined it in his own breast or closet, or to one who has only speculated about it, without attaining any practical result, but it has been expressly held that the terms are applicable to that person only who shall have have invented, published, and introduced into, or put in use, a complete, perfect, and finished invention. The adoption, or the general knowledge of the invention by the public, is not necessary. The title of a person who subsequently lays claim to any exclusive right in respect of the same invention is defeated by the fact, that the complete and perfected invention was so published or put into public use. But the concluding observations of the noble lords, as has been already observed, create considerable doubt and difficulty in the application of the above principles, and the only case to which they appear to be applicable is that of a prior patent, never acted on, and from which the public never derived any practical benefit. Suppose the subject of such patent to be re-invented after fifty years, and to be introduced into general use, and to become part of the manufactures of the country, would the title of such subsequent and independent inventor be defeated by the grant of the prior patent? See *ante* 86, n. *c*."

Although it is true of the present collection generally that it comprehends only the more select of the numerous patent cases which have been decided in our courts of law and equity, there is one particular class of cases of recent occurrence, with respect to which the author has judiciously departed from this principle of selection. We allude to the case brought before the Privy Council, under what is called "Lord Brougham's Act," authorising the Council to extend the term of letters patent under certain circumstances. The whole of these cases, without exception, are reported in the present volume. At the end of 1843, the number of patents prolonged for various periods, varying from three to seven years was seventeen; five applications were refused, and about the same number abandoned by the parties before any hearing.

FRENCH LAW OF PATENTS.

The state of the law of patents in France has been recently the subject of much discussion in the French legislature, and a Bill has just passed the Chamber of Deputies, which, if it meet with the sanction of the Peers, will introduce a number of very valuable improvements—some of which might be adopted with infinite advantage in our own country.

Amongst these improvements the one which is likely to be of most interest and importance to foreigners, is that relating to the mode of paying the government tax on patents. At present it is payable in moieties, one on the application for the patent, and the other after the lapse of six months. In future it is to be paid by equal annual instalments, spread over the whole term of the patent; and a patentee is to be at liberty to cease his payments at any time, should he find that his invention does not answer his expectations, or should he desire, from any other cause, to abandon his patent.

The merit of this most equitable and liberal alteration in the existing law is due to our enlightened and esteemed correspondent M. Regnault, of the French bar, who was a member of the Commission appointed some time ago by the French government to enquire into the laws relating to *brevets d'invention*, and who not only first suggested it, but enforced it with distinguished ability in a petition which he presented on the subject to the Chamber of Deputies.

When the Bill has gone through its remaining stages, and we are able to tell how much of it is embodied into the actual law and practice of our neighbours, we shall return to the subject.

MECHANICAL CURE OF CATARACT.

Sir,—As by mechanical aid we can empty the stomach and bladder, as well as tap for the dropsy, it has occurred to me, that by the same means, in this age of inventions we might extract that suffusion on the crystalline of the eye, which we call cataract—a disease rapidly increasing from the sad misuse in our newspapers of small type, which some people task their eyes to read, in close contact with penumbra lamps, and others of a more fearful degree of brilliancy—many, as I have seen, even placing a small lamp,

on the leaves of the book they are reading, the heat from which, if they are near sighted, inflames the cornea, and hastens, I verily believe, the approach of cataract. Another cause of this disease is the protracted hours these females are made to work, who are connected with dress-making. But to return to my object, which is to propose a remedy, hitherto unthought of; I mean, by tapping the crystalline instead of removing it altogether with its capsule; and this, I think, might be effected, since Mr. Stephenson has proved to the world, that there is no danger in penetrating, with his new-invented lancet, into the interior of the crystalline portion of the eye. I would therefore propose, as an improvement on his discovery, that after making an incision of a certain proportion, by means of an instrument like his, a small delicate tube should be introduced, of a size proportioned to the incision, one end of which should penetrate to the crystalline humour, so as to allow the operator to extract through the tube all that foul suffusion which we call cataract, in order to enable the crystalline capsule to be replenished with a purer fluid. In a matter of such great importance, I trust you will not refuse to convey my ideas on this subject, although no medical man, when you recollect, as I believe was the case, that the stomach pump originated with the carpenter of St. Thomas's Hospital.

I remain, yours, &c.

George Cumberland, Sen.

Bristol, May 10, 1844.

ATMOSPHERIC MARINE ENGINES—THE "SAPPHIRE."

Sir,—The objections of your correspondent "S." to my views, upon the subject of friction, would have been quite correct if I had been discussing the comparative friction of engines of different pressure, and the same construction; but they are not so, as I referred to those of different construction and the same pressure. The friction of a piston is proportional to its area multiplied by the highest pressure, while the power is proportional to its area multiplied by the mean pressure of the steam and vacuum.

In the atmospheric engine the pressure varies; in the double-acting, it is constant. The friction of the piston in the former must therefore be greater in proportion to the power, than it is in the latter.

However, both this additional friction and loss of heat which "S." fears, and which must, if a proper system of felting be adopted, be extremely slight, are more than counterbalanced by the advantages of atmospheric engines in other respects. I cannot see why these engines should be named after Mr. Watt, merely because his condensers are used in them as well as in all other condensing engines of the present day.

I should have thought it more appropriate to name them after the late Mr. Samuel Seaward, who has united the engine of Newcomen and Smeaton to the improvements of Watt, and our modern engineers.

I am, Sir,

Yours sincerely,

Curve.

DR. CLANNY'S SAFETY LAMP.

At the last monthly meeting of the Literary and Philosophical Society of Newcastle-on-Tyne, Dr. Glover read a paper exhibiting the latest improvements effected in Dr. Clanny's Safety Lamp. He commenced by describing the original lamp of Dr. Clanny, which, although safe, was too cumbrous for general use. He then adverted to the lamp invented by Stephenson, who, he said, had undoubtedly made the discovery that explosion will not pass through very small apertures, previous to the researches of Sir Humphry Davy. But, although, to the former gentleman the idea *had* occurred that air might be admitted through apertures smaller than would permit flame to pass, yet he had not arrived at this conclusion by a series of skilful, philosophical investigations, as had been the case with Sir Humphry Davy. Dr. Glover then pointed out defects in the Davy Lamp, which render its appellation of "Safety Lamp" not altogether correct. The wire gauze may be compared to an immense multitude of very short tubes, of small diameter, placed side by side, through which air and light will pass, but through which flame will not pass. It is necessary to prevent the passage of flame through a small tube, that the length of the tube should be considerable in proportion to its diameter. If, therefore, the meshes of the gauze be too coarse, then flame will pass; also, gauze which will be perfectly safe in explosive mixtures in a state of rest, will cease to be so when either the lamp or the mixture is in rapid motion. In constructing a lamp for coal mines, we must make it so that, while it is safe, it will also transmit a sufficient quantity of light. Now it happened, Dr. Glover continued, that in constructing lamps of wire gauze, those two conditions were incompatible. Sir Humphry

Davy's principle was undoubtedly correct, for the aperture in wire gauze can be made so fine that flame will not pass through, but in such a lamp the light transmitted is too feeble to be of any use. It, therefore, happened, that to allow light enough to pass, the meshes of the Davy Lamp were obliged to be made so large as to allow flame, under some circumstances, to pass. After stating the defects of the Davy lamp, Dr. Glover proceeded to consider the various attempts which had been made to remedy them. He briefly referred to the alterations of Clanny, Upton, and Roberts, Stephenson, and Museler, of Belgium, and he gave the preference in every respect to the latest lamp of Dr. Clanny. In this lamp the air is admitted by a wire gauze cylinder, through which the products of combustion also escape. The flame is encircled first by a tube of mica, and then by one of glass, which latter is protected by a brass cage. The great principle in this lamp is, the admission of air to the flame wholly from above. By this means, the influence of currents, acting laterally, is in a great measure prevented, and the light being transmitted through *glass*, the wire gauze can be made of that degree of fineness which will ensure its being safe.—*The Newcastle Chronicle.*

DR. URE'S ALKALIMETER AND ACIDIMETER.

In constructing (1814) the Alkalimeter, I availed myself of the lights recently shed on chemical proportions by Dr. Dalton's atomic theory, and I thus made it to represent, not relative, but absolute measures of the amount of real alkali existing in any commercial sample. The test-liquor used at that time was sulphuric acid, which is most readily and accurately diluted to the requisite degree by means of a glass bead, very carefully made, of the specific gravity that the standard acid should have. In order to make the test-liquor, therefore, nothing more is requisite than to put the bead into distilled water, and to add to it somewhat dilute but pure sulphuric acid, slowly and with agitation, till the bead rises from the bottom, and floats in the middle of the liquor at the temperature of 60° Fahr. The delicacy of this means of adjustment is so great, that a single degree of increase of heat will cause the bead to sink to the bottom—a precision which no hydrometer can rival. The test-tube, about 14 inches long, contains generally 1000 grains of water, and is graduated into 100 equal parts by means of equal measures of mercury. The test-liquor is faintly tinged with red-cabbage or litmus; so that the change of colour, as it approaches to the saturating pitch, on adding it to 100 grains of the commercial alkali, becomes a sure guide in conducting the experiment to a successful issue. One hundred measures of this test-liquor neutralize exactly 100 grains of absolute soda (oxide of sodium), and of course very nearly 150 of potash. A bead may also be adjusted for test-liquors, of which 1000 grain measures neutralize 100 of potash, and therefore 66⅔ of soda, as well as other proportions, for special purposes of greater minuteness of research. One may be so graduated as to indicate clearly a difference of one-hundredth of a grain of ammonia. In making such nice experiments it is, of course, requisite to free the alkaline matter beforehand from sulphurets, sulphites, and hyposulphites, by igniting it in contact with chlorate of potash, as long since recommended by Guy Lussac. With such means in careful hands, all the problems of alkalimetry may be accurately solved by an ordinary operation.

On the same principle my *Acidimeter* is constructed; pure water of ammonia is made of such a standard strength by an adjusted glass bead, as that 1000 grain measures of it neutralize exactly a quantity of any one real acid, denoted by its atomic weight upon either the hydrogen or oxygen scale or radix; as, for example, 40 grains of sulphuric acid. Hence it becomes a universal acidimeter; after the neutralization of 10 or 100 grains of any acid, as denoted by the well-defined colour in the litmus-tinted ammonia, the test-tube measures of ammonia expended being multiplied by the atomic weight of the acid, the product denotes the quantity of it present in 10 or 100 grains. The proportion of any one free acid in any substance may thus be determined with precision, or to one-fiftieth of a grain, in the course of five minutes. Like methods are applied to Chlorometry, and other analytical purposes, with equal facility; adapting the test-liquor to the particular object in view. Instead of using beads for preparing the alkalimetric and acidimetric test liquors, specific gravity bottles or hydrometers may, of course, be employed; but they furnish incomparably more tedious, and less delicate means of adjustment. To adapt the above methods to the French weights and measures, now used generally also by the German chemists, we need only substitute 100 *deci-grammes* for 100 grains, and proceed in the graduation, &c., as already described.

The possession of two reciprocal test-liquids affords ready and rigid means of verification. For microscopic analyses of alkaline and acid matter, a graduated tube

of small bore, mounted in a frame with a valve apparatus at top, so as to let fall drops of any size, and at any interval, is desirable; and such I have employed for many years. Of this kind is my ammonia-meter, used in the ultimate analysis of guanos and other azotized products, in conjunction with a modified apparatus on the principle of that of Varrentrapp and Will. It may be remarked, that when the crude alkali contains some hyposulphite, it should not be calcined with chlorate of potash, because one atom of hyposulphurous acid is thereby converted into two atoms of sulphuric, which of course saturate double the quantity of alkali, previously in combination with the hyposulphurous acid. In such cases it is preferable to change the condition of the sulphurets, sulphites, and hyposulphites, by adding a little neutral chromate of potash to the alkaline solution, whence result sulphate of chromium, water, and sulphur, three bodies which will not affect the accuracy of the above alkalimetrical process.—*Lecture delivered by Dr. Ure before the Pharmaceutical Society.*

NOTES AND NOTICES.

Adulteration of Exciseable Articles.—In consequence of the adulteration of various exciseable commodities having been carried on to a serious extent, the Commissioners of Excise have issued bills calling the attention of the public to the existing legal enactments on the subject, and notifying their intention to enforce the penalties upon manufacturers and dealers in every case in which they may be detected in infringing the law. For this purpose the several acts of parliament on the subject are quoted, and from these it appears that the articles are tobacco and snuff, beer, tea, coffee, chocolate and pepper, all of which, it seems, are frequently so seriously adulterated, or made up with other ingredients, as to defraud the revenue, and to cheat if not to poison the consumers. The following are the heads:—In manufacturing tobacco no other material or liquid is to be used than water, or water and salt, or alkaline salts only, or lime water in Welsh or Irish snuffs, under a penalty of 100*l.* In manufacturing tobacco water only, or in roll tobacco water and oil only, are to be used, under the same penalty. No person shall cut, grind, pound, colour, stain, dye, or manufacture any leaves, herbs, or plants, moss, weed, or wood, chicory, commings, or roots of malt, &c., to be mixed with tobacco and snuff so as to resemble them, under a penalty of two hundred pounds and the forfeiture of all tools and utensils used for that purpose. Beer and worts, it appears, are adulterated with molasses, honey, liquorice, vitriol, quassia, coculus indiæ, grains of paradise, Guinea pepper, opium, calx, &c., as a substitute for malt and hops. The penalty here is 100*l.* with forfeiture of the casks or vessels. The selling of these articles to any brewer renders the party liable to a fine of 500*l.*, and the penalties extend to beer retailers. Adulterating tea with terra japonica, or any other drug or substance other than leaves of tea, 100*l.* Using in tea sloe leaves, liquorice leaves, leaves of tea that have been used, &c., or dying or colouring any leaves for that purpose, 10*l.* Using burnt, scorched, or roasted peas, beans, or other grain or vegetable substance to mix with or resemble coffee or cocoa 100*l.* Manufacturing substances in imitation of pepper, and mixing the same with pepper, penalty 100*l.*

Explosion of a Locomotive Boiler.—On the 1st inst., great alarm was created in the station yard of the Newcastle and Carlisle Railway, at the London road, near that city, by the explosion of the boiler of the "Adelaide" steam engine. The engine had just arrived with a train of empty coal wagons, and, having taken in a supply of coke, was about to start, when a terrific noise was heard, and the whole train enveloped in steam and smoke. On examination it was found that the upper part of the fire box had burst, and had lifted the engine from the rails to a distance of 18 inches, and striking the engine man, had thrown him backwards several yards. The stoker was thrown into the first coal wagon. When the engine man was discovered he was insensible, and though going on favourably, he cannot be pronounced out of danger. The stoker is rapidly recovering.—*Carlisle Journal.*

The Atmospheric Railway System.—At the last meeting of the Institution of Civil Engineers, Mr. Samuda gave the following estimate of the advantages to be derived from applying this system to a long line of railway. Taking for data the expenses on the London and Birmingham railway, which were stated to be per train per mile, for haulage, 15*d.*; ditto, for maintenance, 8¾*d.*; the cost of working the atmospheric apparatus would be—per train, per mile, for haulage, 5 55-100*d.*; ditto, for maintenance, 5 38-100*d.*, with the additional advantage of travelling at a mean speed of 50 miles per hour, instead of between 20 and 25 miles per hour, with the locomotive system.

The Daguerreotype improved by Daguerre.—At the French Academy of Sciences, on the 22nd ult., a communication was made by M. Daguerre, relative to some improvements in the Daguerreotype process, chiefly for the purpose of taking portraits, the ordinary mode of preparing the plates not being found sufficient to enable the operator to obtain good impressions. The new substances of which M. Daguerre makes use are an aqueous solution of bichlorure of mercury, an aqueous solution of cyanure of mercury, oil of white petroleum, acidulated with nitric acid, and a solution of platina and chlorure of gold. The process is as follows:—the plate is polished with sublimate and tripoli, and then red oxide of iron, until a fine black be obtained; it is now placed in the horizontal plane, and the solution of cyanure, previously made hot by the lamp, is poured over it. The mercury deposits itself, and forms a white coating. The plate is allowed to cool a little, and after having poured off the liquid, it is dried by the usual process of cotton and rouge. The white coating deposited by the mercury is now to be polished. With a ball (*tampon*) of cotton saturated with oil and rouge, this coating is rubbed just sufficiently for the plate to be of a fine black. This being done, the plate is again placed upon the horizontal plane, and the solution of gold and platina is poured over it. The plate is to be heated, and then left to cool, and the liquid having been poured off, the plate is dried by means of cotton and rouge. In doing this, care must be had that the plate be merely dried, not polished. On this metallic varnish M. Daguerre has succeeded in taking some very fine impressions of the human figure, which were exhibited.

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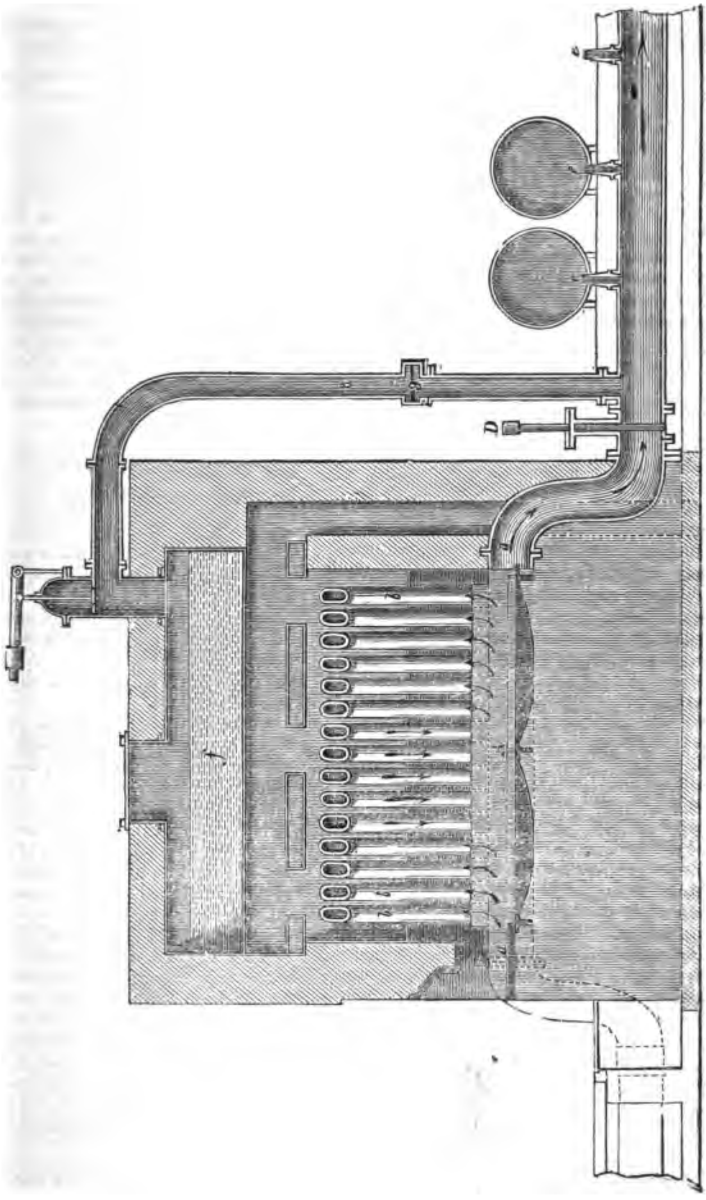
Fig. 1.



MESSRS. DAVISON AND SYMINGTON'S PATENT METHOD OF CLEANSING AND PURIFYING CASKS AND VATS.

MESSRS. DAVISON AND SYMINGTON'S PATENT METHOD OF CLEANSING, PURIFYING AND SWEETENING CASKS, VATS, AND OTHER VESSELS.

[Patentees—Robert Davison, of Brick-lane, Spitalfields, C.E., and Wm. Symington, of East Smithfield, C. E. Patent dated Nov. 2, 1843; Specification enrolled, May 2, 1844.]

THE method of cleansing and sweetening casks, now commonly followed by brewers, distillers, and others, is to pass steam of a high temperature through them; but there are two serious objections to this method—*first*, it is extremely costly, the expenditure, on this account, amounting in some of our large breweries to many thousands of pounds annually; and, *secondly*, the wood imbibes from the steam a quantity of moisture which helps to reproduce those very fungous impurities which it is the special purpose of the process to get rid of. From both these objections the new process, which we are about to describe, is entirely free. It is, comparatively speaking, cheap, and in respect of efficiency subject to no drawbacks. It consists principally in substituting for the steam, *hot air*—that is to say, in administering the heat, in which alone the purifying virtue rests, free from the moisture which accompanies it in the state of steam, and which is found to be productive of more harm than good—a very common-sense-like improvement, and one which, now it has been thought of, every one will (as usual) wonder was not thought of before. The only beneficial effect traceable to the administration of the heat in an aqueous form, is that the moisture helps to loosen and detach any solid matters which may collect on the inside of the casks; but it must be a rough crust indeed which a high degree of heat will not of itself cause to crack and peel off; and for very bad cases of the sort, Messrs. Davison and Symington have a most ingenious mechanical contrivance, which accomplishes more than could ever be effected by steam, in half the time.

Messrs. Davison and Symington describe their method as consisting, "*firstly*, in freeing the wood of casks and other like vessels, while they are in the course of being manufactured and in an unfinished state, from any injurious colouring or flavouring matters with which it may be impregnated, by exposing it to the action of rapid currents of hot air. *Secondly*, in freeing casks and other like vessels after they have been finished, and in use, from any mould, must, fungi, or other like matters, which may collect on the inner surfaces thereof, partly by means of a machine or apparatus, which can be applied inside without removing the heads, partly by rinsing, and partly by causing rapid currents of hot air to pass through them."

The former of these methods is thus described by the patentees,—

"*First*, As regards the casks and other like vessels, while they are in the course of being manufactured, or in an unfinished state. Instead of making them, as usual, of wood which has been dried or seasoned by long exposure to the atmosphere, and is in that condition difficult to bend without blistering, we make use of wood in its new or green state, in which state it is formed into staves of the desired curvature and free from blister, with great facility. We then form, or 'block off,' as it is called, the casks or other like vessels, by putting the staves and heads together, and binding them by temporary fastenings, and making due allowance for the shrinkage which afterwards takes place. We next subject these unfinished casks, vats, or other vessels to the action of a continuous and *rapid* current of heated air, until the wood has exhaled every particle (or nearly so) of its natural sap, or other aqueous particles with which it may have become impregnated. And this done, the casks are finally hooped and finished off in the usual way.

"The construction of the apparatus by which we produce the rapid current of heated air is represented in figs. 1, 2 and 3; fig. 1 being a sectional elevation; fig. 2 a plan, and fig. 3 a transverse section of the same. A is the furnace; *a a a*, are horizontal pipes which extend along the sides of the furnace, and *b b b*, pipes of a horse-shoe form, which rise vertically from the horizontal pipes and communicate therewith; *c* is a passage for the inlet to the horizontal pipes of atmospheric air from a fan-blower, or other impelling apparatus; *d*, a passage for the outlet of the heated air from the pipes, which is furnished with a sluice cock D, to prevent the steam, when used, from passing into the hot-air pipes, *b b b;* and *e e e*, nozzles through which the heated air rushes into the casks, or other like vessels. The arrows indicate the course which the air takes in passing to the nozzles."

The hot air, it will be observed, must

Fig. 11.

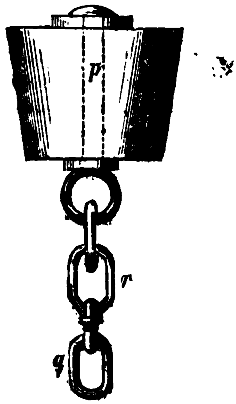


Fig. 4.

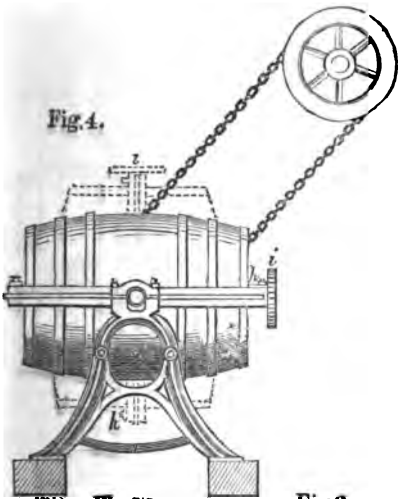


Fig. 7.

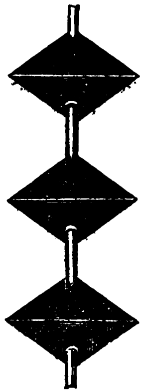


Fig. 8.

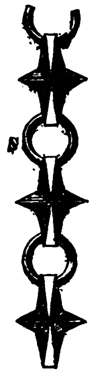
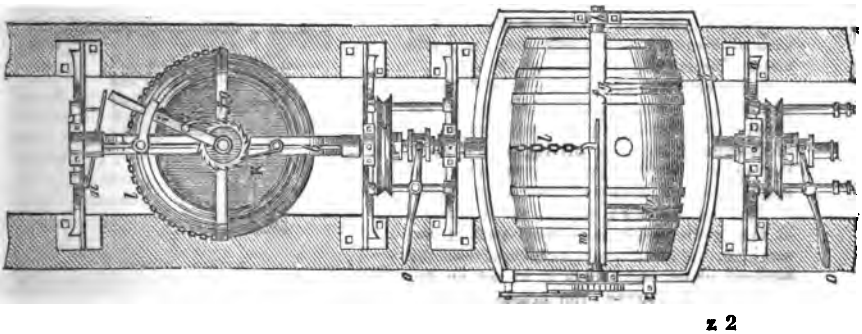


Fig. 10.

Fig. 9.

Fig. 6.



have a *rapid* current given to it; the requisite intensity of evaporation, not being, we understand, attainable from heat of however high a temperature, when applied at low rates of speed. Of the *second*, and perhaps more important branch of the invention, the patentees give the following description:—

"*Second*, As to the cleansing of casks and other like vessels which have been in use, we proceed as follows: We first clear them from all extraneous matters of a solid nature, which may have collected on the inside, as mould, must, or fungi, by means of the machine represented in figures 4, 5 and 6; figure 4 being an elevation; figures 5 and 6, plans of the same. *a a a a*, are the standard supports of the machine; *b b b*, a frame which has its bearings, and revolves within the standard supports, *a; c c*, a rigger, which gives motion to the frame *b*; *d*, a driving pulley, fixed on a horizontal shaft, *z*, which gives motion to the rigger *c*, through the medium of a chain *e; f, g*, an inner frame or cradle, which rests in, and turns on bearings, *h h h*, in the outer frame *b*, and on which the cask to be cleansed is placed; *i i i*, a ratchet and spring lever fixed on the spindle of the cradle, *f, g; k k*, springs or palls; *l l l*, lever and chain which secure the casks on the cradle; *m*, a catch to hold the lever; *n n*, an inclined plane for causing the lever to act on the ratchets; *o o*, clutch handle for throwing the machine in or out of gear; *p*, a plug, shown on an enlarged scale at fig. 11, which fits into the bung-hole, and from which is suspended inside of the cask a series of cleansing chains separately represented in figs. 7, 8, 9 and 10, and immediately afterwards described. First, there is attached to the plug, by means of a staple, or eye, a few inches of common chain, *q*, with a swivel *r*, in some part of its length. To this chain there are attached by means of a ring, three pieces of large chain, *s s s*, of about 3 feet each in length, front and side views of which are given in figs. 7 and 8, and to each of these lengths of large chain are attached by a ring, three pieces, *t t t*, of smaller chains, each of about 12 inches long, front and side views of which are given in figs. 9 and 10.

"The action of the machine is as follows: The cask, or other vessel, having been secured in the cradle *f g*, motion is given by the horizontal shaft, or driving pulley, *d*, to the rigger *c*, which causes the frame *b*, and cradle *f g*, to revolve. As soon as the ratchet and lever, *i i*, affixed to the spindle of the cradle, reach the bottom part of the machine, the lever comes in contact with the inclined plane, and causes it to act on the ratchet, and thereby the cradle to move

Fig. 2.

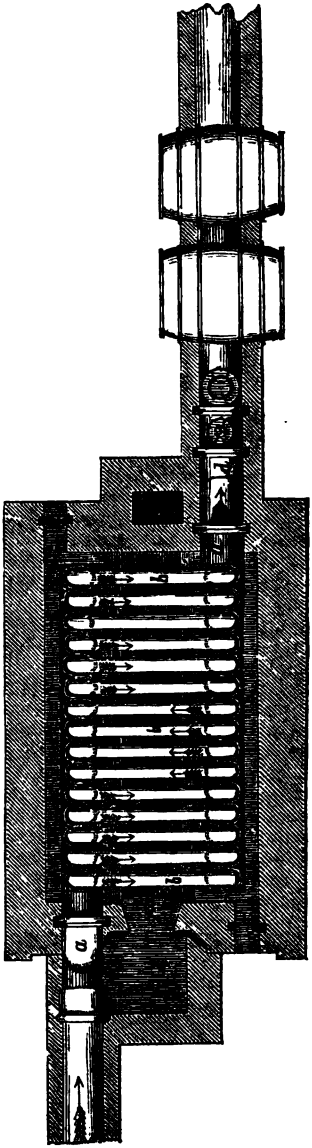
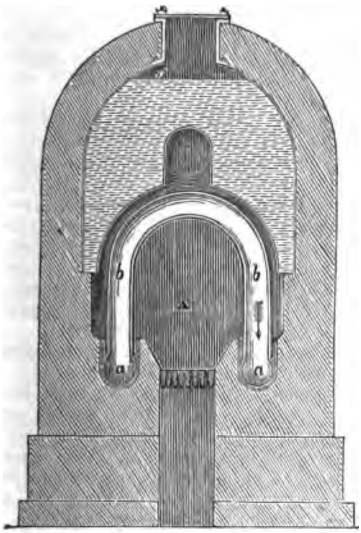


Fig. 3.



sidewards to the extent of one tooth of the ratchet. And so on, for every revolution the outer frame makes, the cradle, or inner frame moves sideways, and completes an additional tooth in the ratchet. The chains, mean while, by the numerous angular points which they present to the inner surface of the cask, detach whatever foreign substances may be adhering thereto. After this cleansing has been effected, the chains are easily withdrawn from the cask by means of the plug to which they are attached. We next rinse them well, preferring to use, in the case of beer barrels, a small quantity of beer of the same sort as that with which it is intended to fill them subsequently. In the case of spirit casks, this part of the process is dispensed with. As the wood of the casks may have imbibed various noxious matters which the mechanical operation of the chains could not remove, we next, in order to get rid of such matters also, and thus sweeten the casks thoroughly, expose them to the action of a rapid current of hot air, by placing them with their bung-holes over the nozzles, *e e*, of the hot-air apparatus before described, taking care, first, to remove the corks from the tap holes, so that a free passage may be left for the aqueous and other vapours generated by the action of the stream of hot air. Where a very high temperature is found necessary to purify the casks from every perceptible taint of must or charr, or other bad odour, it may be found useful to introduce along with, or in addition to, the hot air, a small quantity of steam, and for this purpose there is a boiler (*f*, figs. 1 and 3,) placed over the heating pipes, having a pipe (8) furnished with a sluice cock (9), through which the requisite supply of steam may be conveyed into the hot-air exit pipe."

The drawings, figs. 4, 5 and 6 represent only two casks, as mounted on the machine, but the patentees state, that "any number of frames and casks may be made to revolve at one and the same time by the application in any of various well-known methods of driving pulleys, or wheels set in motion by any adequate power."

DAMASK BLADES.

Sir,—In the Appendix to the interesting narrative, recently published by Captain Abbot, of his journey to Khiva, there is a translation of a paper on Damascus or Damask blades, by Colonel Anossoff, director of the celebrated Russian manufactory at Zlatoost, in Siberia, with a Note by the translator himself, both of which contain a great deal of very curious information on the subject; but, cooped up where it is, it has but small chance of attracting the notice of those best calculated to turn it to practical account. I beg, therefore, Sir, to suggest that you would confer an obligation on many of your mechanical readers, as well as render a real service to the arts of metallurgy, were you to transfer these papers to your universally read repository of scientific and mechanical knowledge. I enclose copies of the papers, and am, Sir,

Your constant reader,

An Indian.

J. U. S. Club, April 15, 1844.

Colonel Anossoff's Treatise.

In Russia we understand by the Damask, a metal harder, and supplying a material for arms of keener edge, than ordinary steel.

Our poets, ancient as well as modern, generally arm their heroes with damask blades, a proof that this kind of arm has long been known in Russia; although the art of their fabrication was unknown, and that of distinguishing them was anything but popular.

The original country of the damask is the East, and there is reason to think, that its properties were even less understood in other countries of Europe than in Russia. To judge how far they were from having just notions regarding this metal about fifty-five years ago, one need but cast the eye over the work entitled, "Histoire du fer, du

metallurgiste Suedois, Rinmunn," a standard work in its day. Even to our own days, the nature of the damask is an enigma, not only as regards its chemical structure, but even its physical properties.

All the researches of chemists have, until now, failed of discovering any essential difference between the damask and ordinary steel; which nevertheless proves only that the analysis has been imperfect: it is only want of means that prevents success. Notwithstanding the rapid progress of chemistry, it has not yet attained perfection, and perhaps many things must remain for ever impenetrable secrets to the art. Although the chemists of the present day presume that the natural damask is the effect of a crystallization, produced by retarded cooling of the heated metal: yet, not having the means of producing a damask equal to the ancient work of Asia, they cannot establish this ground; although they have before their eyes the laws of crystallization discovered by the mineralogist Haüy.

If crystallization generally is but the result of the structure of bodies, under certain physical considerations; the question follows, wherefore in the damask is it not the result of a similar cause; and as common steel acquires no visible damask by gradual refrigeration, is not this a convincing proof that the composition of damask differs from that of ordinary steel? If chemical analysis fails to discover that difference, we can only conclude that it answers not its end. The researches of metallurgists and of artificers, who have been at pains to make the damasks, and to inform themselves of the ancient art, have made no decisive progress. I have seen no damask of superior quality wrought in Europe: and that which has been written upon the subject, gives no sufficient light: for I have found in no treatise upon the damask any provision for perfecting the steel. Thus, on one hand, the imperfection of our chemical knowledge, and on the other, the difficulty of fabricating the damask, leave Europeans still in uncertainty as to its merits. Many scientific men, relying upon chemical analysis, refuse credence to the superior qualities of the damask; whilst amateurs, who have any knowledge of the subject, set as great value upon it as do the people of the East, and willingly pay 50*l.*, and upwards, for the best damask blade.

Time out of mind the damask has been used in Asia; and to this day it has lost nothing in price. Nevertheless the Orientals, although less advanced in knowledge than ourselves, could not be deceived, throughout the course of ages, upon the merit of objects purchased only at a very high price.

It is about ten years since this consideration made me doubt the infallibility of the results of chemistry, and incline to the judgment of the ancients, as better founded, upon the question of the damask. Thence originated my desire to observe the different qualities, and to discover the means of its fabrication.

The first comparison of the Russian damask before the tribunal of the public, at the approaching exhibition of Russian fabrics, induces me to publish, although in an abridged form, my ideas upon the subject of the damask, acquired during an experience of ten years. Perchance they may serve to facilitate a discrimination of the various kinds of damask, to such of my fellow manufacturers as have yet enjoyed little opportunity of examining and testing them.

All steel, which exhibits a surface figured with dark lines, is called damask.

In some of the various kinds of steel, these figures appear immediately after burnishing; whilst in others, dilute acid is necessary to bring them out. The juices of plants, and ordinary vinegar suffice for this effect. The process of bringing out the figures of steel, is called corrosion.

The damascene which appears upon the surface of steel is very various: nevertheless this damascene does not *alone* confer upon steel the title of damask; on ordinary steel, similar figures may be brought out, by subjecting it to corrosion, after having designed upon it the figures required: but, whatever pains may be taken to make such resemble genuine damask, the eye of a connoisseur easily detects the counterfeit, without examining the quality of the metal. Hence has arisen the epithet of "false damask."

A second kind of damask exhibits also an artificial damascene, which nevertheless is peculiar to the metal itself, so that, how often soever it is repolished, the same figures will reappear whenever it is subjected to corrosion. This damask is known as "artificial damask." It is composed of several sorts of steel interlaid with iron. The beauty of such damask is various, and consists partly in the quality of the several materials, partly in the skill with which they are worked together. These artificial damasks are chiefly wrought in Asia, viz. India, Turkey, Georgia; but the artificial damasks of Europe have attained as yet no great reputation, because the European workmen are more intent upon producing elegant figures on the steel, than in improving the metal itself. Thus the artificial damasks, as those of Solinger and Klingenthal, although exhibiting the damascene, have not the figures characteristic of superior metal.

In fine, whatever may be the beauty of artificial damasks, they will not bear comparison with good natural damasks, for if filed, the damascene does not re-appear.*

The natural damasks of Asia differ from the artificial, in the re-appearance of their inimitable and (so to speak) innate damascene, as well as by the faculty of re-producing the same damascene after having been filed; if the constituent particles remain unchanged.

In Asia we observe many kinds of damask. The difference between them depends upon the places in which they have been wrought, the manner of their fabric, and the various qualities of the material. Those most in use, are known by the names Dābān, Kārā Dābān, Khorussaun, Kara Khorussaun, Gundy, Koum Gundy, Neuris, and Schaum (Syria.)

The Orientals judge of the goodness of the damask by its figures, by the colour of the ground (that is, the intervals between the figured lines), and by the play of colours. They consider the Daban and Khorussaun (to the latter they sometimes add Kara or black) to be the best blades. The Schaum is the least esteemed. The constant experience of many years assures me that the marks upon which the Orientals found their judgment of the goodness of the damask, are a more certain criterion of the true quality of the metal, than all the tests to which it is subjected in Europe: these, enabling the testers to form no more than a proximate estimate of the quality of the steel, most generally during the process of fabrication, and not after completion of the object; the quality of which still remains to be determined by proofs, conformed to the purpose for which it is designed. As the mark of the workman is the sole guarantee of the quality of the work, so the Asiatic is never deceived in the intrinsic value of the damask; and fails not to laugh on seeing an European test its quality by filing it, or making it cut iron; especially as the hardness of metal is conditional, depending upon its temper. If the damask be carefully corroded, all further test is needless.

As above stated, the first and most essential sign of the damask is its damascene. In proportion as it is thick, defined, fantastic, in the same proportion is the quality of the metal fine. The thickest damascene is about the size of the notes of music, the middling as large as ordinary print, and the finest is that which we can just follow with the naked eye. As to the method of recognising the quality of damask by its figures, and to the re-appearance of the damascene, although they depend upon invariable laws, it were easier to give an idea by samples than by simple description. Nevertheless it may not be useless here to add certain directions upon the subject, which are not founded upon practice alone, but proved by the process I employ in the fabric of damask.

Like written characters, the damascene consists of points, of right lines, and curves; which serve to distinguish the quality of the damask, as follows:—

1st. The damascene formed principally of right lines, almost parallel, denotes the lowest quality of the damask.

2nd. When the right lines become shorter, and are partly replaced by curves, they denote a better quality than the first.

3d. When the lines are interrupted, show points, and when the dimensions of the curves increase, this is a still better symptom.

4th. When the interrupted lines become still shorter, or rather, when they change to points, as they increase in number, so as to form in the breadth of the steel here and there, as it were, nets, interlinked by threads which undulate in diverse directions from one net to the other. In this case the damask approaches perfection.

Finally, when the nets open farther to form figures resembling grapes, or when they occupy the entire breadth of the steel, and partake it in nearly equal articulations; in that case the damask may be recognized as of the highest possible quality.*

Another feature, by which the quality of damask may be understood, is the hue of its ground. The deeper the tint, the more perfect the metal. The ground of the damask may be grey, brown, or black.

A third feature is the play of colours upon the metal, when its surface is subjected to an oblique light. In observing many thus, we perceive, that some amongst them show no variation of tint, whilst others take a crimson or a golden hue. The more perceptible this play of colours, the finer the quality of the damask. Nevertheless this test is affected by the degree of corrosion. When the corrosion is very great, the play of colour is not observed. No art can pro-

* I must beg to differ with my ingenious friend in this matter; if indeed I have rightly translated him. Damask formed of mixed metals will re-appear, however much it may be filed. This is a fact well-known to all gun-makers, who employ iron of several different colours, in forging gunbarrels, to give them what is called the twist, in other words an artificial damascene.—My friend must here be alluding to "false damasks."—*Capt. Abbot.*

* Damask blades of this description are found in the museum of rare objects of the aid-de-camp general Perroffski, an officer who, by his love for the arts and sciences has entered deeply into my researches; and by his condescending kindness in procuring me access to damasks of the most perfect kind, has greatly contributed to my stock of information.—*Captain Abbott.*

duce the red hue upon inferior damask. Therefore the damask may be divided into two distinct classes, viz. that which has the red hue, and that which wants it.

When the three characters, above noted, are found in union and at their maximum, we may confidently pronounce the damask to be of the most perfect kind, which will in no case fail of the following qualities:—

Perfect malleability and ductility. The hardest possible substance after tempering. The keenest and firmest possible edge. And elasticity, when properly tempered.

The other damasks possess various degrees of perfection, according as the three above-named qualities are more or less remarkable.

I do not follow the nomenclature of eastern nations in defining the varieties of damask, because they do not always denote the various degrees of its perfection. It appears to me more convenient to use in Russia, a nomenclature, founded upon the water alone. By this rule, five kinds of damask may be noted, viz.—the streaked, the striated, the reticulated, and the knotted. Each of these five kinds may have one of the following characters—

a A damascene, coarse, middle sized, or minute.

b A ground, grey, brown, or black.

c A hue changing in the light to red; or exhibiting no change.

Amongst damasks of inferior quality, may be found some, inferior to cast steel of medium quality; but it is not known that the best cast steel may compare with the finest damask. Comparative proofs have convinced me, that the damask offers the highest possible perfection of steel; and the relations we receive from those who have visited Japan, the Indies, Persia, and Turkey, are not so exaggerated as many suppose. A well-tempered sabre of good damask, will easily sever bones, iron nails, and the most flimsy kerchief as it floats in the air. But I must beg leave to doubt the possibility of performing similar feats with similar ease with European blades, such as those of Klingenthal, as we are assured, in a late publication;* for I am persuaded that the blades of Klingenthal, of Solingen, as well as those of Zlataooste, of similar temper to good damask, cannot be compared with the latter, whether in edge, in solidity, or in elasticity.

The employment of damask might, I think, be extended with advantage not only to the fabric of arms, but in general to every steel article requiring edge or solidity.

Note by Captain Abbot.

So far Colonel Anossoff, a man whose researches in this department of science have enabled him to revive the natural damask in a degree of perfection which I have never observed in the workmanship even of the ancients, and which certainly cannot be approached by fabrics of any eastern nation at present existing.

This, it will be allowed, is very high authority; the more especially as the Russian collections exhibit probably a greater variety of damasks than those of any other European nation. And to differ in any point with such an authority, may not only seem presumptuous, but may absolutely ensure the rejection of my opinions as futile. Nevertheless, as I have taken upon me to reprint his valuable remarks in a work of my own, it seems incumbent upon me to add to them some of the results of my own experience.

I have from childhood had a passion for everything connected with arms, and have never neglected an opportunity of examining such as came within my reach, and of reading and carefully treasuring all that is written upon the subject of their qualities and construction. I have also cursorily run over great part of Asia, have been many years in India, and have examined three or four of the principal collections of blades in Russia. The result of my experience and researches, would assure me, that either Colonel Anossoff's oriental classification differs essentially from that prevailing in Khorussaun, or that our estimates of the qualities of the damask are at variance.

The blade known in Khorussaun as *the* Khorussaunie blade, has a very dark hue, betraying a steel highly carbonised. The figures of its damascene are very various, and I despair of giving any distinct idea of them without the aid of plates, which my present position precludes me from attempting; the more especially as nearly all my collection of swords and daggers has been lost in my late wanderings.

1. The kind least esteemed is a light grey, having a granulated surface, the spots of which are rather long in the course of the metal. This kind is also forged at Lahore and Siroee.

2. The second kind has a figuring of coarse dark lines upon a grey ground. These lines exhibiting figures almost precisely similar to the grain of a young oak, when the oblique section has passed near the centre of the tree.

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* Manuel complet de travail des Metaux, traduit de l'Anglais du Docteur Lardner, par A. D. Vergnard. Paris, 1838.

3. A third has the same grey ground and dark irregular lines, but these are more continuous, and not disposed in concentric figures, but have rather the appearance of tissues of wire, running into every serpentine shape.

4. A fourth is a repetition of the last, but the lines are finer, and the figures more uniform in their irregularity, forming homogeneous masses, so to speak. This is the kind most highly esteemed by the people of Khorussaun. It varies greatly in beauty and value, and may be purchased at from 5*l.* to 500*l.*

5. A fifth kind exhibits a series of articulations, of which I have counted thirty-six in a sword blade. These articulations, or knots, are formed by dense masses of nearly parallel lines, disposed lengthwise in the blade; the masses running into one another. At the junction they are excessively fine. On turning the blade, it will be found that each junction on the one side corresponds with the centre of a mass on the other; a proof that the blade had been formed of two distinct laminæ welded together; and a strong presumption that the articulations are artificial, and that the junctions are considered by the workman as the weak points of the steel. This is certainly the most beautiful variety of Khorussaunie blade; but I have not observed that it is so highly esteemed as the finer kinds of the foregoing variety. It varies greatly in quality, the finest lines denoting that which is considered best.

All these blades, when attentively scrutinized, will be found to possess a seam down the back, betraying the welding of the double plate of which they are composed. None of them possess any elasticity. They will either break short, like cast iron, or bend like lead. I have never observed in the finer kinds any supe[illegible]in edge, over the elastic blades of Ger[illegible]but the inferior kind, being often mor[illegible]tempered, are keener, and very brittle. Their shape is a simple, and often an abrupt wedge, the very worst of shapes for cutting, owing to the great friction which the lips of the wound exert upon the sides. Their figure is too crooked for defence. They are not esteemed unless a cat can walk under the curve when placed edge upwards on the earth; neither is this degree of curve sufficient to confer great value, unless it be elegant in its gradations. The edge is generally obtuse, and seems formed rather to bear the shock with armour and with other blades, than to cut deep. The breadth is seldom great, but they are thick at the back, and always ill-poised. The best are from Isfahaun; but I understand that the art is almost lost, even there. The best I have ever seen I bore as a present from the King of Khaurism to the Emperor of Russia. Its ground was a greyish azure, in which the lines were most delicately traced in somewhat darker dye. It was not articulated. The back had a coarse seam throughout its extent, which had been so imperfectly welded, that the blows of the Kuzzauk clubs opened it. This seam is, I think, invariable in the finer Isfahaunie blades. I believe the object of it to be twofold. In the first place, to have as large a surface as possible purified by the action of the hammer; and secondly, by doubling back the plate, to secure an edge free from wiry particles. The blade in question had very little elasticity. I have never seen a Khorussaunie sabre pointed with a double edge. It is true that the blade is too crooked to be used in thrusting; yet I have seen Damascus blades equally crooked, that had the double edged point.

The daggers of Khorussaun are somewhat different in water or damascene from the sabres of that country; greater care seems to have been taken in the process. The lines upon them run into the most delicate and perfect spirals, and minute curves. Their appearance, I should say, offers abundant evidence of their being forged of mixed metals: probably they are bundles of wires, of spiral forms, welded together in a mass. They are generally of the most elegant figures; seldom double edged, probably from the superstition against this figure prevalent at Khiva, where the double-edged dagger is religiously disused, because Hosein, the son of Ali, was slain with a double-edged knife. The point is generally triangular and tapering, serving well to force the links of chain armour, which was once commoner than at present. They have, however, a double-edged dagger called Khunja, which is worn in Persia, although that people being Sheeahs, are so much more interested in the fate of Hussun and Hosein.

One of the peculiarities observable in all good Khorussaunie blades is, that toward the edge the hue of the steel increases in depth, betraying more strongly the presence of carbon; a fact which proves that a mixture of metals was employed in this species of damask, the harder disposed toward the edge of the blade, the less brittle at the back, with the view to combine the greatest keenness of edge, with tenacity to resist concussions.

In Colonel Anossoff's oriental nomenclature, occur several names unknown, I think, in Khorussaun and India, for instance, Dābān Gundy, and Neuris. Upon these I can of course offer no remarks. But with respect to the blade of Schaum, I know not how the

Tartars dwelling in Russia may apply the epithet, but its real and original meaning is the blade of Damascus; a city which has given name to all steel fabrics exhibiting upon their surface, what is termed, water. It is true that the art of damascening seems in the present day to be lost at Damascus, and the blades forged in Syria may therefore deserve the contemptuous estimate which the Tartars of Russia seem to entertain for them. But there can be little doubt, that of all watered blades, the Damascus blade was the most perfect, and the only blade of this description, anciently forged, that had any elasticity. I confess I have never met with an elastic Damascus blade, but there seems to be sufficient evidence that the ancient fabric was elastic. We read an absurd account of a Damascus blade, appertaining to the celebrated Khaliph Haroon ool Rusheed, so elastic, that the monarch usually carried it coiled up like a watch-spring in his turban, and travellers give frequent testimony to its elasticity. As few Asiatic swords are flexible, the idea could not have entered the mind of an Asiatic, without same foundation in fact. And, as European travellers would naturally, after the fashion of their people, test any sword brought for examination by bending it, they could scarcely have fallen into error on this point.

A blade that was in my possession, essentially different from those of Khorussaun and India in figure and texture, and wrought in Egypt, probably by Syrian workmen, exhibited the most exquisite water, and an edge that I have never seen equalled. But, although not brittle, it was unelastic. Its structure could scarcely be attributed to the natural arrangement of fibre of the steel, in the process of crystallization. I have no doubt that the blade of Damascus was of this character. Though probably in the present fabric, iron has been substituted for soft steel, and thus the elasticity is lost. It is to be observed, that such blades are generally so massive as to render elasticity a matter of little moment, as they will not shiver in any concussion, and scarcely any force to which a sabre is liable will materially impair their straightness. Their colour is a very pale azure. The streaks are delicate, elegantly waved, and curved, much fainter than in the Khorussaunie blades, and appear to be brought out without aid of acids, by the mere action of the atmosphere. Nothing that I have seen approaches in beauty to these blades, or in firmness and keenness of edge. The people of Khorussaun term them Misrie, that is, Egyptian, and believe that they will sever steel. The kingdoms of Egypt and Syria having lately been under one head, I have little doubt that whatever art of damascening remains in either land, will at present be found at Alexandria and Cairo.

The streaked damask, spoken of in Colonel Anossoff's Memoir, I have not noticed, because I do not conceive it to deserve the title, being a wretched imitation of the Khorussaun blade.

Of the damask of Hindoostaun I am not prepared at present to speak largely. It is forged at Guzeraut, Siroee, and Lahore. Its water is granulated. Its edge is keen. It is, I believe, invariably brittle. I must except the Siroee blade, as I have seen of this but few specimens. That of Lahore appears to me the worst. The damask of Guzeraut is extremely hard and keen edged, but so brittle, that a back of soft iron is added, as in bone saws, to fortify it. It is one of four kinds of blade forged at Guzeraut, if I may credit general report. One kind being fabricated at each of the four gates of the city. One of the plain Guzerautie blades is elastic, and superior to any other of Indian manufacture.

With the exception of Indian varieties of damask, and of that first noted in my list, I should confidently pronounce all the above damasks to be artificial, *i. e.* the effect of human art in the arrangement of the fibre; not the result of any particular structure in the crystallization of the metal.

The Russian damask, on the contrary, discovered by my friend Colonel Anossoff, is natural. It is a peculiar modification of cast steel, by which it is impressed with a peculiar character in its crystallization. Which character betrays itself, when the corrosion of acids, by acting more violently between the interstices of the structure than elsewhere, traces out the arrangement of the crystals. This property is communicated to the damask of Zlataoost by a process tending to perfect the quality of the steel, and to impress upon cast steel the elastic properties of a softer material. The general fault of European blades is, that being forged of shear steel, for the sake of elasticity, they are scarcely susceptible of the keen edge which cast steel will assume. The genius of Anossoff has triumphed over this objection, not in hardening the soft steel, but in giving elasticity to the hard; and it may be doubted whether any fabric in the world can compete with that of Zlataoost in the production of weapons combining in an equal degree edge and elasticity. The water of this variety of damask resembles most that of No. 5, of my list above. It is a succession of small bundles of almost parallel lines, occupying the whole breadth of the blade; the ends of the bundles crossing and mingling at the point of junction. I have called them nearly

parallel lines, because such they are to superficial observation. They are, however, a series of minute curves, forming together lines, disposed in bundles articulated together, and dividing the length of the weapon into many sections. They have not the regular articulation of the articulated Khorussaunie blade, but their lines are infinitely finer. I have seen several, which were condemned for insufficient temper, submitted to the action of the engine by which they are broken. The blades were bent double, and back again, several times ere they could be divided. The red hue observed upon damask blades I have seen only on those of Zlatavost.

ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

WILLIAM NEWTON, OF CHANCERY-LANE, C.E., *for certain improvements in the preparation of paper designed for bank notes, government documents, bills, cheques, deeds, and other purposes wherein protection and safety from forgeries or counterfeits are required.* (Being a communication from a foreigner residing abroad.) Patent dated June 10, 1843; Specification enrolled December 9, 1844.

The paper made use of for the purpose of this patent is directed to be of the sort which is manufactured by hand, with rags naturally white, and not bleached by chlorine. To render it a "safety" paper it is to be covered well over with two designs "composed of elements regular and irregular." The "regular" designs are to be "easily perceptible and recognizable by the naked eye;" "*geometrically* regular;" distinguishable by "great purity and distinctness in the lines, and great symmetry in the disposition of the constituent parts; free from straight lines, because they are too easily made with a rule," and from all curves "which may be traced at once by a compass;" and they are to be distributed over the surface of the paper "*with a mathematical precision*, so as to offer an uniform tint." The *irregular* designs are to be "produced by chance, so that it shall be impossible to obtain two similar drawings by using the same means, or any other;" they are to be so minute that "they can only be seen by means of a magnifying glass;" and they are to be inserted between the spaces left between the regular elements.

The mode of producing these two sorts of designs, or "the organization" of them, as it is called by the patentee, is as follows.

"A matrix or mother design composed of *regular* elements in the condition above stated, is to be engraved by means of a point and a suitable engraving machine, or by any other method of producing the same result capable of engraving a given device or design *ad infinitum*, and with the greatest precision. This design may be engraved or marked on a lithographic stone, or even on a block of wood; but a steel plate is preferable, as this description of work requires great precision.

"A proof is taken from this plate in the ordinary manner of copper plate printing, and transferred on to the lithographic stone by the means now known and employed by lithographers. The transfer being thus made, I then, by means of a brush, and gum arabic dissolved in water, and slightly coloured, or any other substance soluble in water, cover all the regular elements constituting the design transferred on to the stone. This covering, which is not applied over the intermediate spaces left between the regular elements of the design, is allowed to dry. Then a second drawing is transferred on to the whole of the same stone, this latter drawing being composed of *irregular* elements much smaller than the regular elements of the first drawing, and which may be microscopic.

"It will be understood that the regular elements being protected by the gum covering, and the intermediate spaces alone being left, it is only on the latter parts that the stone will receive the second drawing.

"This drawing is previously to be made on a sheet of metal, or stone, or even on wood. It may be etched and engraved by the hand, by machinery, or by a chemical process; but whether made on a metal plate, on stone, or by a lithographic operation, it must necessarily be obtained by chance, so that it cannot be reproduced, either by the process that effected it, by any other process, or by the hand of an artist.

"I shall point out, by way of illustration, some of the means which may be employed to attain this result.

"One may take resin, or colophony, in powder of a middling fineness, and sift it on to a lithographic stone previously heated. When the grains or atoms of resin are fixed by the heat, the stone must be corroded by a solution of nitric acid, and thus an irregular ground is obtained.

"One may also make an irregular ground on a lithographic stone, by taking a brush with short hairs or bristles, dipping this brush in thickened llihographic ink, and striking gently or irregularly on the surface of the stone with the extremity of the brush; the ink thus laid on the stone is to be fixed by the ordinary process.

"One may also cover a lithographic stone

with lithographic ink, which is allowed to dry; then, on the whole of the blackened surface, an engraver's roller is to be rolled irregularly to obtain white points on a black ground.

"The owner of this plate may take proofs from the same, transfer them on to stone that he may take casts from it, cause it to be reproduced by the polytype and electrotype process; but neither the author himself, nor any other person could make a second plate identical with the first, except by some of the above means of multiplication.

"The *irregular* ground being obtained by one of the modes above stated, or some mode equivalent, I take a proof from the plate, and transfer it on to the lithographic stone which has received the *regular* drawing as above stated.

"The transfer being made and fixed on the stone, I remove the gum by which the regular elements have been covered, and then I can have lithographic impressions on which may be distinguished, by the naked eye, the regular elements surrounded, but not covered by irregular and microscopic elements.

"Instead of composing the matrix or mother plate by transfer taken from two separate plates, this object may be effected by executing on the same plate on which the regular design has been already engraved, and by any of the means above indicated, or by any other appropriate mode, the irregular design forming the ground, so as to obtain a mother plate without a transfer.

"The matrix or mother plate thus obtained, twenty, or a greater number of plates should be produced, in order to guard against any accident which might happen to the matrix or mother plate.

"These plates, which I shall call *seconds*, are obtained by taking proofs from the mother plate, transferring them on to stone, and fixing them thereon.

"From the *seconds* impressions are taken, and that may be done *ad infinitum*; these proofs are transferred on to lithographic stone, the lineaments are brought up in *relievo* by the ordinary process of engraving upon stone, and then the impression may be produced by the typographic press."

To prevent any impression of these drawings from being transferred on to stone, and afterwards multiplied at will, the patentee employs certain peculiar inks in a peculiar manner.

"I prefer delible inks made with a mixture of oil, gum, or resin, because they are more easily employed in typographical impressions. I make a certain quantity of *white* ink, composed of balm, capahu, Venetian turpentine, and chalk previously washed and dried. These substances are ground together until they are brought to the consistency of ordinary printing ink. I call this ink No. 1. I take one half of it and set it aside; in the other half I introduce a sufficient quantity of ordinary ink, reduced to powder by evaporation. This is done in order to give the necessary colouring, that the design to be printed with this ink may be visible to the naked eye, and at the same time that the writings made on the prepared paper may be perfectly apparent. This second sort of ink I call ink No. 2.

"Instead of dried ink for colouring the ink No. 2, I may use any other colouring substance which is equally delible, or as easily obliterated as common ink powder, in order that any attempts to extract part of the writing formed on the paper may cause the extraction or obliteration of the visible design printed on the paper with this delible ink.

"An impression is made on both sides of the paper with ink No. 1, and to effect this, old plates, and those which are defective, are suited to this first impression, which, not being visible, need not be made with plates free from defects.

"The visible design is then printed with ink No. 2. This latter impression is made with all possible care, and consequently with lithographic stones engraved or prepared with great precision and care. After these two impressions the paper is dried, pressed, and cut, and shaped for use.

"A very good ink for printing the visible design may be made as follows:—

"1. Chalk well washed	20 to 25 parts.
"2. Common ink reduced to powder, or by preference, gallate of iron............	4
"3. Ultra marine blue..	1
Varnish........	*quantum sufficit.*

"This varnish, as well as the one above stated, is composed with equal parts of balm of capahu and Venetian turpentine, melted together, and to be used when cold."

To exemplify the security thus obtained, the patentee supposes the case of an attempt being made to alter a deed written on safety paper of this description.

"If a forger attempts to extract a word or a sentence, or any quantity of writing formed on the safety paper, presently described, he will begin to use chlorine; this agent will destroy the colour of the writing, and that of the visible impression, the colouring principle of ink No. 2 being the same as that of ordinary ink. He then will use an acid to remove the oxide of iron, which will still leave traces in the place of each letter, and each lineament of the visible design, which traces cannot be obliterated by chlorine. In this second operation the acid

will have destroyed also the chalk contained in ink No. 1 and ink No. 2. The safety paper thus treated will retain at the spot obliterated only the slight marks produced in the substance of the paper by the pressure of the two impressions and the resinous principles of the two inks employed, for no vestige will remain of the ink with which the writing was formed. But neither the slight marks left in the paper by the printing of the visible design, nor the vestiges left by the resinous varnish of ink No. 2, will be of any use to the forger in his attempt to reconstruct the design at the place obliterated. To the marks made by the printing of the visible and invisible designs, and the vestiges of the resinous principles left on the paper by the inks No. 1 and No. 2 will be so complicated, and so much worked into one another, that it will be impossible to distinguish any thing.

"If, moreover, the conditions of the designs, or the principles upon which they are constructed, are referred to the numerous points of comparison which the same piece of paper will naturally offer, the perfection of the part executed by machinery, the impossibility to imitate by hand or machinery the part executed by chance, every one will be convinced that the reconstruction of part of the design will be utterly impossible, and the reproduction of a design by a lithographic transfer will be equally impossible.

"In fact, whatever be the process employed to transfer the design on to stone, it will be impossible not to transfer at once the two designs, the visible and invisible one, as both are printed with a resinous ink at the same moment, and the only substance which distinguishes the two printing inks is a small quantity of dried ink powder, which can have no influence on the transfer, being mixed with a resinous body, which is more readily transferred on to stone than itself."

The claim of the patentee is as follows:—

"I claim the covering of paper intended for all the purposes indicated in the title of the patent, with two designs composed of elements regular and irregular, and obtained by the means hereinbefore described, one of the designs being printed in visible ink, and the other in invisible ink, both these printings being delible, by employing which means it will be found impossible to reconstitute or reconstruct the design, of which part has been extracted by chemical agents, and an equal impossibility of transferring the whole design on to stone, in order to multiply it at will by impressions taken therefrom, and thus a complete guarantee is given to government, to trade, and all private transactions."

HENRY PINKUS, OF NO. 1, DUKE-STREET, PORTLAND-PLACE, ESQ., *for improvements in the method of applying motive power in combination with apparatus and machinery to certain purposes in propelling, and applicable to railways, to ships, or other vessels afloat.* Patent dated July 13, 1843; Specification enrolled January 13, 1844.

Mr. Pinkus proposes to lend the declining canal interest a helping hand, by showing how water-ways and iron-ways may be advantageously combined in one system. Steam engines in a great degree similar to those of locomotives, and having tubular boilers, are to communicate an alternating motion to two rods of wood or malleable iron from 10 to 20 feet in length, connected at one end to the boat, and resting at the other end upon a line of rails laid along the banks of the canal or placed upon piles driven into the bed of the same. The ends of the rods resting upon the rails, are provided with friction rollers which enable them to slide easily when a forward motion is communicated from the engine; but upon the return stroke there are two grippers attached to the ends of the rods, one placed on each side of the rail, which are so arranged, that they firmly embrace it, and by so doing, pull forward the boat, instead of allowing the rod itself to be drawn backward. Both rods are placed upon the same side of the boat, and making their strokes alternately produce a continuous forward motion in the boat. Or, instead of the preceding plan, a continuous rope, or chain may be made to revolve over one pulley attached to the engine, and upon a second one placed on those ends of the rods, which rest upon the rails, from which motion may be communicated to pulleys embracing the rail, and the boat be thereby drawn forward.

REV. WILLIAM FLETCHER, *for securing corks, or substitutes for corks in the mouths of bottles, or vessels of the nature of bottles, whether made of pottery, or of pottery of the kind called stone ware, or of glass.* Patent dated August 24, 1843; Specification enrolled February 24, 1844.

Make your bottle with two small holes in the neck opposite to one another, and pass a pin through these holes into or through the cork or stopper; do this, and you will accomplish all that the Rev. Mr. Fletcher has thought it necessary to secure to himself and his licensees by his letters patent. "I would remark," he says, and he does remark, "that the position of the holes and the shape of the bottles *may be varied.*" A prudent reservation this—every way in keeping with the extreme originality of the invention. The claim is to the making of the holes in the necks of the bottles only,—the holes to suit in the corks or stoppers, it is left to some other ingenious inventor to monopolize by patent.

Frederick Isaac Welch, of Birmingham, Manufacturer, *for a certain improvement, or improvements in the manufacture of leather.* Patent dated November 2, 1843; Specification enrolled May 2, 1844.

These improvements consist in subjecting skins of enamelled leather to pressure (by rollers or any other suitable means,) while the enamelled side is in contact with a suitably engraved surface. After a skin has undergone one such operation, its position with respect to the engraved lines on the plate is changed and the operation repeated, so as to produce cross lines, or the appearance commonly called "graining." The inventor states, that by this process "not only will the graining" be performed more uniformly than heretofore, but the texture of the leather be improved.

The *claim* is to the "producing on the surface of enamelled leather any impressed pattern or device, resembling, or in imitation of the appearance commonly called "graining," whether such improved pattern or device be produced by the method before described, or by any other of the well-known methods of impressing surfaces."

Luke Smith, of Manchester, Mechanic, *for certain improvements in or applicable to looms for weaving various kinds of fabrics.* Patent dated November 16, 1843; Specification enrolled May 16, 1844.

The improvements described in this specification are principally applicable to power looms, but partially also to hand looms. The *first* consists in the application of two shuttles so disposed, the one on the top of the other, that as they pass simultaneously along the lathe, each leaves its distinct thread of weft, the one being on the upper side, and the other on the under side of the different sheds of the warp. The two threads may of course be of different colours.

The *second* improvement consists in substituting for the different tiers of shuttles now in use, a shuttle-box which revolves upon a centre, and is susceptible of being turned round with suitable gear by the application of the foot to a treadle; it is divided into separate compartments, varying in number, according to the variety of weft required; and each compartment contains a shuttle, or a pair of shuttles, used in the manner first described, so that any shuttle or pair of shuttles can be brought into play, and the weft be distributed at regular, increasing, or decreasing intervals. It is stated not to be necessary to have a revolving shuttle-box placed on each side of the loom, but that by having it so, greater variety can be given to the cloth.

The *third* improvement relates to the picking apparatus through which the motion is communicated for throwing the shuttle or shuttles.

The patentee *claims*, 1st, The application of two shuttles, as above described, whereby two weft threads are thrown into the different sheds of warp. 2nd. The application of the revolving shuttle-box. And 3. The picking apparatus through which motion is communicated for throwing the shuttle.

John Withers, of Smethwick, Stafford, Manufacturing Manager, *for an improvement or improvements in the manufacture of glass.* Patent dated November 16, 1843; Specification enrolled May 16, 1844.

Mr. Withers states that the improvements which form the subject of this patent were suggested by and based upon the application of a patent granted to Mr. James Timmins Chance, of Birmingham, for his method of annealing plate glass. According to the method referred to, the plates, as they are taken from the flattening kiln, are laid upon a railway truck, which is then introduced into the annealing kiln or furnace, at the hottest end, and gradually moved forwards to the other end in process of cooling. The improvement of the present patentee consists in having the railway truck formed into a chamber with wheels, whereby it can easily be removed from place to place. The movable chamber is formed of plates of iron fitting with air-tight closeness to one another (iron being preferred to every other material on account of its cheapness, and being a good conductor of heat), and one side of the chamber is hinged to the other parts, so as to admit of being readily opened and closed. The plates from the flattening furnace are put into this movable chamber, and the door closed, after which it is removed to a convenient place to cool.

The patentee *claims*, 1st, The mode described of annealing or cooling plate glass (which is stated to be also applicable to other glass manufactures) in a movable chamber. And, 2ndly, The metallic chamber, such as above described.

NEW WORKS CONNECTED WITH THE ARTS AND SCIENCES PUBLISHED IN MAY.

Septenary System of Generating Lines by Simple Continuous Meter. Illustrated by 10 Plates, containing Examples and Registers of a few hundreds of the Curves produced by Jopling's Double Cranks of the most simple construction. By Joseph Jopling, Esq., C.E. No. II.

The Arithmetic of Annuities and Life Assurance; or Compound Interest Simplified; explaining the Value of Annuities Contingent on One or Two Lives, and the Values of Assurances in Single and Annual Payments, and comprehending the Values of Leases, Pensions, Freeholds, and Reversionary Sums, in Possession or Expectation, Imme-

diate, Deferred, or Temporary, illustrated with Practical and Familiar Examples. By Edward Baylis, Actuary of the Anchor Life Assurance Company. 5s.

A New System of Music, which by its application much simplifies the practice and acquirement of the pianoforte and other musical instruments, with instructions for learners and several tunes printed in colours. By D. D. Jameson. 10s. 6d.

Periodicals.

The London, Edinburgh, and Dublin Philosophical Magazine. No. 157. 2s. 6d.

The Edinburgh New Philosophical Journal. No. 75. 7s. 6d.

The Civil Engineer and Architect's Journal. No. 81. 1s. 6d.

The London Journal (Newton's). No. 149. 2s. 6d.

The Repertory of Patent Inventions. Enlarged Series. No. 19. 3s.

The Glasgow Practical Mechanics' and Engineers' Magazine. Part 32. 8d.

The Artizan. No. XVI. 1s.

The Builder. Part XIV. 8d.

The Nautical Magazine. No. 16. Enlarged Series. 1s.

Pharmaceutical Journal and Transactions (Bell). 1s.

The London Polytechnic Magazine. Edited by Thomas Stone, M.D. No. 5.

Annals and Magazine of Natural History, including Zoology, Botany, and Geology. By Sir William Jardine, Bart., P. J. Selby, Esq., Dr. Johnson, &c. No. 135. 2s. 6d.

The Zoologist. No. XXXVII.

The Phytologist; a Popular Botanical Journal, on the plan of "The Zoologist." No. II.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65. FROM 26TH APRIL TO 20TH MAY, 1844.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
April 26	170	Giles Little; Peter Grimmo	Fetter-lane; Vine-court, Spitalfields	Plaited taper fly-line.
27	171	Richard Kitchen	Sheffield	Improved corset busk.
29	172	Henry Weir Collinson	14, Stamford-street, Blackfriars	Portable apparatus for shaping hats.
„	173	William Glegg Glover	8, Chester-square, Middlesex	Design for window sashes.
30	174	Green and Bently	33, Compton-street, Brunswick-square, London	The Protean reflecting oven.
May 1	175	William Dent	Newcastle-street, Strand	Design for an improved urinal.
2	176	Joseph Weldin	Worcester	Design for an elastic glove.
3	177	Robert Fry	Tockington, Gloucestershire	Design for the configuration of a bed, or floor for thrashing grain and seeds, and for breaking stones or other matter.
4	178	David Middleton, Jun.	Lincoln	Chimney pot and cowl sweeper.
8	179	Isaac Luggitt	Howden, County of York	Design for a new lamp for burning spirit.
11	180	Wm. and Joseph Harcourt	209, Bristol-street, Birmingham	Harcourt's sliding blind pulley.
„	181	George Thomas Caswell	Wolverhampton, Staffordshire	A double-acting pump.
„	182	Vincent Price	Wardour-street, Soho	Design for a manumotive carriage.
14	183	William Warne	Lark-hall-lane, Clapham	Cordwainer's standing or sitting machine.
15	184	Benjamin Hick and Son	Bolton, Lancashire	Design for a portable forge.
„	185	William Beynon	Newhall Works, Birmingham, and Falcon-square, London	Trowser-strap fastener.
„	186	H. Negretti	19, Leather-lane, London	Thermo-hydrometer.
18	187	A. Saxon	St. George's Road, Manchester	Design for a tin bobbin.

LIST OF ENGLISH PATENTS GRANTED BETWEEN APRIL 27, AND MAY 23, 1844.

Pierre Armand Lecomte de Fontainemoreau, of Skinner's-place, Size-lane, merchant, for a new mode of constructing barometers and other pneumatic instruments. (Being a communication.) April 27; six months.

John Dixon, of Wolverhampton, iron master, for improvements in heating air for blast furnaces, and for other uses. April 27; six months.

Arthur Wall, of Bisterne-place, Poplar, surgeon, for certain improvements in the manufacture of steel, copper, and other metals. April 27; six months.

Josiah Clarke, and Samuel Fletcher, of Hulme, Lancaster, machine makers, for certain improvements in wheels to be used in slubbing or bobbin frames, and in roving or jack frames, and for other purposes, and also in the engine by which such wheels are or may be cast. April 27; six months.

Isaiah Davies, of Birmingham, engineer, for certain improvements in steam-engines, part of which improvements are applicable to impelling wheel carriages. April 27; six months.

Edward Cobbold, of Melford, Suffolk, master of arts, clerk, for improvements in the preparation of peat, rendering it applicable to several useful purposes, particularly for fuel. April 27; six months.

William Clarke, of Nottingham, lace manufacturer, for improvements in machinery for manufacturing ornamented bobbin net, or twist lace. April 30; six months.

William Jeffries, of Little Sussex-place, Hyde Park Gardens, for improvements in sweeping chimneys, and in apparatus to prevent chimneys from smoking. April 30; six months.

Robert Gordon, of Heaton Foundry, Stockport, millwright and engineer, for improvements in grinding wheat and other grain, and in dressing flour or meal, which improvements in grinding are also applicable to grinding cements and other substances. April 30; six months.

William Fairbairn and John Hethrington, of Manchester, engineers, for certain improvements in stationary steam boilers, and in the furnaces and flues connected therewith. April 30; six months.

Jacob Samuda, of Southwark iron works, engineer, and Joseph D'Aguilar Samuda, of the same place, engineer, for certain improvements in the manufacture and arrangement of parts and apparatus for the construction and working of atmospheric railways. April 30; six months.

John Melville, of Upper Harley-street, esquire, for improvements in the construction and modes of working railroads. April 30; six months.

James Hayman, of Mount-street, Lambeth, corn-dealer, for an improved construction and arrangement of certain parts of omnibuses and other vehicles. April 30; six months.

Robert Corden, of Nottingham, tobacco manufacturer, and Sidney Smith, of the same place, engineer, for improved economical apparatus for making gas for illuminations. April 30; six months.

John Constable of Lime-street, London, merchant, for certain improvements in the manufacture of sugar. (Being a communication.) April 30; six months.

William Colborne Cambridge, of Market Lavington, Wilts, agricultural machine maker, for certain improvements, first, in machinery for rolling or crushing ground; second, for cutting and thrashing agricultural products; and third, an improved adaptation of horse power to threshing machinery, which may also be applied to other purposes. April 30; six months.

Charles Watterson, of the firm of Macguire, Watterson, and Co., Manchester, soap manufacturer, for certain improvements in the manufacture of soap. May 8; six months.

Joseph Wright, of Gough-street, Gray's Inn-lane, coach builder, for certain improvements in railway and other carriages. (Being a communication.) May 8; six months.

James Grant, of Vine-street, Westminster, gas-fitter, for improvements in the means of ventilating buildings and other places where a change of air is required. May 8; six months.

William Vose Pickett, of Tottenham, esquire, for certain methods of preparing in metal, or other substances, the parts and features of architectural construction and decoration, and for applying the same in the construction and arrangement of houses and other buildings. May 8; six months.

John Loach, of Birmingham, manufacturer, for a certain improvement in corkscrews, which improvement is also applicable to cocks or taps, and valves. May 8; six months.

Alfred Toy, and Edward Hanson, of Castle-street, Holborn, lamp manufacturers, for improvements in consuming tallow and other fatty matters in lamps. May 7; six months.

Thomas Grimsley, of Oxford, sculptor, for a new method of constructing a self-supporting fire-proof roof, and other parts of buildings, with bricks and tiles formed from an improved machine. May 14; two months.

John Browne, of New Bond street, esquire, for improvements in apparatus for protecting the human face, or part of the human face, from the inclemency of the weather, part of which improvements is applicable to protect birds in cages. May 14; six months.

Edward Hill, of Hart's Hill, Worcester, iron manufacturer, for improvements in the manufacture of railway and other axles, shafts, and bars. May 14; six months.

William Walker, jun., of Brown-street, Manchester, hydraulic engineer, for improvements in warming and ventilating apartments and buildings. May 14; six months.

William Palmer, of Sutton-street, Clerkenwell, manufacturer, for improvements in the manufacture of wicks for candles and for lamps, and in the manufacture of candles. May 15; six months.

Charles Hancock, of Grosvenor-place, Middlesex, esquire, for certain improvements in cork and other stoppers, and a new composition or substance which may be used as a substitute for, and in preference to cork, and a method or methods of manufacturing the said new composition or substance into bungs, stoppers, and other useful articles. May 15; six months.

Hesketh Hughes, of Chiswell-street, Middlesex, gentleman, for an improved machine for crimpling, fluting, and quilling muslin and other fabrics. May 15; six months.

Peter Armand le Compte de Fontainemoreau, of Skinner's-place, Sise-lane, London, for a new and improved mode or method of paving and covering roads and other ways or surfaces. (Being a communication.) May 15; six months.

Henry Holmes, of Derby, cutler, for improvements in the manufacture of bricks, tiles, and other plastic substances. May 15; six months.

John M'Intosh, of Glasgow, gentleman, for certain improvements in revolving engines, and an improved method of producing motive power, and of propelling vessels. May 17; six months.

James Pilbrow, of Tottenham, civil engineer, for certain improvements in the machinery for, or a new method of propelling carriages on railways and common roads, and vessels on rivers and canals, &c. May 17; six months.

Thomas Martin, of Withybush, Haverfordwest, Pembroke, for certain improvements in the construction of slated roofs, flats or floors, tanks or cisterns, or reservoirs for water, and in pipes, tubes, or channels of the same materials for the conveyance of water. May 22; six months.

James Petrie, of Rochdale, Lancaster, engineer, for certain improvements in steam engines. May 22; six months.

James Perkins Chatten, of Saint Martin's-court, gentleman, for improvements in the manufacture of dead eyes for the purpose of setting up the rigging of ships and other sailing vessels. May 22; six months.

James Bremner, of Pulteney Town, Caithness, civil engineer, for certain arrangements for constructing harbours, piers, and buildings in water, for cleansing harbours, and for raising sunken vessels. May 22; six months.

George Gwynne, of Princes-street, Cavendish-square, gentleman, and George Fergusson Wilson, of Belmont, Vauxhall, gentleman, for improvements in treating certain fatty or oily matters and in the manufacture of candles and soap. May 22; six months.

Joseph Meeirs, of Ludgate-hill, for certain improvements in weaving, and in weaving machines. May 22; six months.

John Henry Moor, of Lincoln's-inn-fields, gent., for certain improvements in the construction of carriages generally. May 23; six months.

William Johnson, of Bury, Lancaster, agent, for improvements in machinery or apparatus for preparing cotton, wool, flax, and other fibrous substances. May 23; six months.

Richard Wilson, of Newcastle, builder, for improvements in the manufacture of tiles. May 23; six months.

John Wilkie, of Glasgow, mechanic, for improvements in machinery or apparatus for working wood into the various forms required for making doors, window-shutters, window-sashes, mouldings, flooring, and other purposes. May 23; six months.

John Taylor, of Duke-street, Adelphi, gent., for certain new mechanical combinations, by means of which economy of power and of fuel are obtained in the use of the steam-engine. May 23; six months.

William Archibald, cooper, of New Mills, Ashbourne, Derby, gent., for certain improvements in machinery for spinning cotton wool, and other fibrous substances. May 23; six months.

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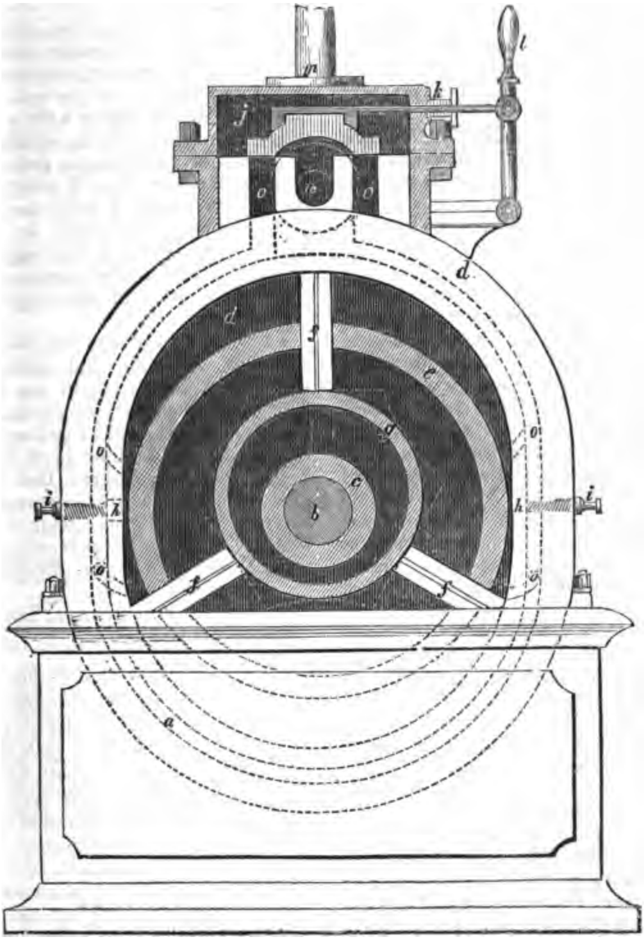
MUSEUM, REGISTER, JOURNAL, AND GAZETTE

No. 1086.] SATURDAY, JUNE 1, 1844. [Price 3*d*.

Edited by J. C. Robertson, No. 166, Fleet-street.

JONES'S PATENT ROTARY ENGINE.

Fig. 1.



JONES'S PATENT ROTARY ENGINE.

Sir,—To "*make use of a passing friend*," is an every-day occurrence in life; but sometimes the favour asked, and the liberty taken, is beyond that of decency, and therefore unwarrantable. But, as it often happens when legal rights are infringed upon, that they are restored by an appeal through the intervention of that most powerful of all presses (although it is said that the power of the hydraulic is unlimited), the *public press*, I respectfully solicit you to employ it to obtain, if it be possible, the restitution of certain privileges which it is conceived have been claimed by another, and which, it is hoped, will be *dis*claimed, and restored to the aggrieved parties, without recourse to other proceedings.

In your Magazine, No. 1080, April 20, 1844, an engraving with description is given of a rotary steam engine recently patented by Mr. Peter Borrie, and therefore the public naturally expect to find *some features of originality*, and *not a mere colourable evasion* of another rotary steam-engine, *precisely the same in principle*, which was priorly patented, through your office, by Mr. John Jones, on the 7th October, 1841, together with other improvements, and in particular the Cambrian or *half-beam direct-acting oscillating piston engine*, of which you gave a commendatory notice in your Magazine for 1842, and which, you will be happy to learn, has, by its invariable performances during the last two years and a half, given the utmost satisfaction. I inclose a sketch of the rotary steam-engine referred to, a bare inspection of which will satisfy any one that it is the *same in principle*, and nearly so in detail (excepting that its construction is more simple) as that which Mr. Peter Borrie has thought proper to launch into the world as an original invention of his own.

The following is the description of the engine given by Mr. Jones in his specification:—"*a* is the framing; *b*, the piston shaft; *c*, boss of ditto; *d*, elliptically shaped steam chamber; *e*, revolving piston; *f f f*, three slides acting in grooves of the piston; *g*, one of two circular or hexagon rings (there being one on each side of the piston) which act eccentrically upon the slides *f f f*; *h h*, metallic packings and coiled springs at each side of the internal surface of the elliptical steam chamber, which packings press against the piston as it revolves, and are kept tight or regulated by means of four screws *i i i* (two of which only are seen in the figure); *j*, the case of the steam slide or valve; *k*, stuffing-box of gearing for reversing motion; *l*, handle of the gearing; *m*, induction steam pipe; *n*, eduction steam pipe; and *o o o o*, passages for the ingress and egress of the steam."

If it should be asked why Mr. Jones's rotary engine has not been brought forward, the reason is, that neither Mr. Jones nor myself consider that the rotary principle, however judiciously modified, is equal to that of the well-tried and efficacious steam-engine with a reciprocating or vibrating piston, which opinion is generally entertained and founded upon experience; but if rotary engines are preferred (and I have the vanity to believe that Mr. Jones's is the best hitherto produced), I can supply such engines, as well as the Cambrian, being equally interested in the proprietorship of both inventions.

I have to apologize to you, Mr. Editor, for thus intruding and soliciting the insertion of this letter in the pages of your valuable periodical, which, like the *Public Ledger* of old, I consider is "open to all parties, and influenced by none." I feel therefore assured that you will give publicity to this statement, and thereby "render unto Cæsar the things that are Cæsar's," and merit to whom merit is due; remaining, Mr. Editor,

Yours respectfully,

H. Crosley, Engineer.

59, King William-street,
May, 1844.

[We have taken the liberty to omit some things in this communication from our esteemed friend, Mr. Crosley, which, however well founded in fact they may be, have no reference to the question of the similarity between the rotary engines of Mr. Jones and Mr. Borrie.—Ed. M.M.]

ON LIGHT.

Sir,—This paper will be confined to an essay on Light, in the course of which, without scrutinizing the opinions of others, it is intended only to set down facts, and

the inferences resulting from them, with such observations as the occasion may require, and so to leave them with the world.

How, or by what means, the images or forms of things are impressed on the organs of vision; how things become visible, or by what means they appear, are important and interesting questions. We say it is by light we see objects. But what is light? and how does it enable us to see them? In answer to these questions it may be confidently asserted, (for in this paper it will be proved,) that light is a ponderable substance; that it is air in a state of radiation; that is, air issuing in rays or streams from a common source, as from the sun, or from a jet of burning gas; and that the appearance of things is caused by air in that state of action. When the rays proceed from the source of radiation to the object, and thence to the eye, the object appears by reflected light. For a portion of the light which strikes bodies always rebounds or glances off: and this property of light, which seems to arise from its elasticity, and the swiftness and force with which its rays proceed, is called reflection. But the quantity of light which glances from objects is not the same in all cases. It differs with the texture, smoothness and colour of the substances, and the degree of obliquity at which the light strikes them. More light rebounds or glances from bright substances than from dark ones: and more when the light strikes the substance obliquely, than when it strikes directly. By reflected light all opaque objects appear. When the rays proceed directly from their source to the eye, the object seen is either luminous or transparent; and appears by direct radiation. In both cases, a communication between the eye and the object is effected by the rays of the fluid which pass from the object to the eye, and impress its form or image on the organs of vision. Light, therefore, is not a distinct essence, nor a separate element; but it is matter in a state of action; in which sense the word Light is used in this paper. It is used to designate air in a state of radiation. Hence some new term may be deemed necessary to represent the state of things—to express the truth—but to me it appears more conducive to the advancement of science that the meaning of words in use should be well defined, than that new ones should be introduced.

Light may be caught and examined; when it is found to be quiescent air. Thus, if a burning light from a lens, of 5 or 6 inches diameter, be thrown upon sealing wax, immersed in cold water, the light enters the wax, and issues out again in globules of air, which arise from the parts touched by the focus, accompanied by a crackling caused by the bursting forth of the fluid; and by the operation of the light deep pits are made in the wax. If such a light be thrown upon a piece of stone, wood, rusty iron, black flint, black cloth, or any dark substance, so immersed, globules of air in abundance arise from the parts touched by the focus: and in all these cases, the path or passage of the light from the lens through the water, to the object on which it acts, is visible. This is the commencement of the process of burning; which, when exposed to the action of the atmosphere, that element completes; and it also shows the effect of light upon substances in water. Its effect on substances in other liquids is also worthy of trial. That the globules, in all these cases, are air, may easily be ascertained in the following manner:—Take a glass shade, such as is commonly used for covering artificial flowers, 4 or 5 inches deep, and 3 or 4 inches in diameter at the mouth; immerse it in a vessel of clear water, and turn the mouth downwards, taking care to turn the glass under water, so as to exclude the air and leave the glass wholly occupied by the water. Then put the wax or other substance to be operated on under, and leave it inside the glass, and apply the focus of the lens to it, and as the globules of air arise from the substance they are stopped and retained by the shade. With this apparatus, I have obtained air globules in abundance from black sealing wax, rusty iron, wood, black cloth, and black flint; from lead and white pebbles, a few minute globules, and perhaps a few from copper; of that, however, I am not certain; on one occasion, I thought I perceived globules of air from copper, but on another occasion, I concluded there was none. But from gold, silver and glass none can be obtained with a lens of 5 inches diameter; because the gold and silver reflect a large portion of the light thrown upon them, and the glass transmits it, or rather the light passes through the glass. With a more powerful lens, I have no doubt, air would be obtained from

copper; and I think from gold and silver, and perhaps from transparent substances, for they arrest and retain a portion of the light which penetrates them. The air obtained is permanent. It may be retained for any length of time. In some of these experiments, part of the water was poured out of the vessel containing the apparatus, so as to lay bare the top of the glass shade; the light had then only to pass through the glass, and the water under it, to the object, which was elevated or depressed at pleasure. And the more the object was raised towards the surface of the water, the greater was the effect produced by the focus. The effect is the same whether the water has been previously boiled or not; but it is somewhat less in sea water than in fresh water.

This is not air liberated from the substances by the action of the light, because air, without diminution, may be obtained from the same substance, so long as there is light enough to make a strong focus; nor is it air from the water; for it evidently issues out of the substances; and if it were from the water, it would come from the gold and silver, as well as from the iron and wax. It is from the light. These facts show that, solar light is air in a state of radiation. They also show with what facility air, in that state of action, passes through transparent substances, and how it penetrates and is arrested by opaque ones. These conclusions inevitably result from the preceding facts; it seems impossible to resist them. These facts also illustrate the effects of the burning glass operating on substances in air. In this case the light evidently penetrates the substances and makes way for the air to enter them; and when the light is sufficiently concentrated, the particles composing bodies are, by the power of these agents, separated, and the appearances called burning and melting are produced; the nature of which operation is more easily comprehended, when we consider that the atmosphere is an immense ocean of extremely subtile fluid, resting on the face of the earth, in the bottom of which man lives and all his works are carried on; that it presses with a force of upwards of 14 lbs. to the square inch on all objects at the earth's surface;* and that it penetrates, permeates and saturates all solid substances, animate and inanimate, living or being therein. Such indeed are the solvent powers of solar light and atmospheric air, when their action is combined and sufficiently concentrated, that few things, if any, can resist them.

And quiescent air may be put into a state of radiation; when it becomes *light* and causes objects to appear. This truth is proved by every burning jet of gas; for the gas is air. And atmospheric air, under some circumstances, will also burn and become light. If common coal gas be allowed to flow through the tube which conducts it into an apartment, it will soon fill the room, render it uninhabitable, and, if ignited, will explode. But if, when the gas begins to flow, a light be applied to the jet, the issuing air is thrown into a state of radiant action, —a flame appears—and the air, as it issues from the tube, reunites with the atmosphere. During all the time the air or gas burns, it is flowing rapidly into the room without materially vitiating the atmosphere of the apartment, as it would do if unlighted, because it reunites with the atmosphere as it issues from the tube. It unites with a radiant action which makes things appear, and if they are brought near to the source of action, will burn such of them as are combustible and reduce them to ashes.

I am, Sir, yours with much respect,

G. Woodhead.

INSTITUTION OF CIVIL ENGINEERS.

MINUTES OF PROCEEDINGS, SESSION, 1844.

"*Description of a Water-wheel constructed by Mr. W. Fairbairn, M. Inst. C. E., and erected in Lombardy.*" *By Shute Barrington Moody, Grad. Inst. C. E.*

The chief peculiarities of this wheel are stated to consist in the introduction of the

* The reality of the atmosphere is shown by the suspension and floating of the clouds, the flight of birds, the rise of balloons, and especially by that modern wonder, the Atmospheric Railway, (for without the atmosphere none of these could exist,) and by its ability to displace, and where it can get a rest, to keep out liquids. And that the atmosphere has an upper limit, or surface, not very many miles above the surface of the earth, is shown by the decrease of its pressure with the distance from the earth's surface, as indicated by the descent of the quicksilver in the barometer on occasions of ascent in the atmosphere.

Air, under ordinary circumstances, is not visible, but it becomes visible by contrast. The globule which we see in liquids, termed a bubble, is a lump or mass of air. The bubble is not a vacuity, but space occupied by air, from which it has displaced the liquid.

tension principle of for the arms, and the ventilating system for the buckets.

The use of wrought-iron bars for the arms and braces materially diminishes the weight, as, owing to their superior strength in resisting shocks, fewer centres and arms are required, and consequently a lighter shaft can be used. The repairs are also less frequent, and are not so expensive as in wheels with cast-iron arms.

The advantage of the ventilating system is, that all the water, which in the ordinary construction would splash with the air from the bucket and be lost in the race, is conducted by an inner sheathing or sole plate, into the lower buckets, while the air is enabled to pass off freely, behind this inner sheathing; the effective power of the wheel is thus increased, and its action is stated to be very satisfactory. The average speed is 5·25 feet per second, and the buckets are generally about two-thirds filled.

The communication is accompanied by a drawing, showing the elevation and section of the wheel.

Mr. Albano stated, that having been called to Lombardy in the year 1840, for the purpose of erecting a mill for spinning and weaving flax, he selected a spot at Cassano d'Adda, where he found a stream of water, which at that time could only drive two pair of corn-mill stones, and two saw frames, each containing two long perpendicular saws.

He conceived that this power might be employed more advantageously by improving the water-course, and had succeeded eventually in enabling it to give motion to upwards of six thousand spindles, and a number of power-looms. For this purpose he designed the general plan of the mill, and of the water-wheel which had been described, and had intrusted its execution, with other parts of the millwright work, to Mr. Fairbairn, adopting, at his suggestion, the ventilating principle for the buckets, which had proved very advantageous. In the ordinary form of buckets, the air not being able to escape, prevented them from being filled, and thus the power of the wheel was diminished. For the purpose of avoiding that loss of power, Mr. Albano had originally designed the top of the feeding cistern to be cast of an open pattern, so as to allow the air to pass away freely, but that plan had been partially superseded by the ventilation of the buckets.

The drawings did not show, what he considered an important improvement, in the method of governing the opening of the breast shuttle. Mr. Fairbairn's usual plan was to have a shaft across the feeder, with a chain attached to the rack, and a heavy balance weight suspended from it over the water. Mr. Albano had modified this system by introducing gearing, and a second motion, with a supplementary shaft extended into a vault beneath the mill; a much smaller balance weight thus regulated the movement of the shuttle with great ease, and it was so delicately balanced, that on one set of spindles being stopped, it was immediately perceived from the action of this governor.

Mr. Fairbairn's usual practice was, to make the periphery of his wheels move at a velocity of from 4 feet to 5 feet per second for low falls; but Mr. Albano had increased the velocity of this wheel to 5·25 feet per second, which he found to be very advantageous, and more convenient for driving machinery, which was required to attain a very high velocity. He found the effective work of the wheel to be about 0·60 of the water expended.

Mr. Mallet had found that the co-efficient of the majority of the wheels constructed in this country, was between $\frac{5}{10}$ths and $\frac{6}{10}$ths.

Mr. Taylor said, that in the session of 1842, he had given a statement of the average performance of a number of wheels, employed in pumping from some mines in Devonshire, and it was found to be 63·3 per cent.

Mr. Glynn stated, that the general work of good overshot wheels might be taken at two-thirds of the water employed to turn them, supposing that the water was required to be raised again to its original level. This included the friction of the pumps, rods, &c.

"*Description of a Water-Meter.*" *By P. Carmichael, (Dundee).*

This meter is stated to have been used for some time, for the purpose of supplying the three steam boilers of an engine of 80 horses power, and by it, the evaporative powers of the boilers, which were of different forms, and the value of various kinds of fuel, have been carefully tested.

Its action is thus described: within a closed box which will contain 50 gallons of water, a copper float is placed, so as to move up and down freely, on a hollow spindle between two stops; by means of levers and a spanner, which are acted upon by the float, two conical valves are alternately opened and shut, as the box is required to be filled, or its contents to be allowed to pass to the boiler. The float ascends above the top, and descends below the bottom of the box, in cavities arranged for the purpose, by which means only a given quantity of water is passed through the box at each descent of the float. It is found by practice, that each discharge contains exactly the same quantity of water.

The communication is illustrated by three detailed drawings, showing the construction of the machine.

*"Dr. Roth's Automaton Calculator."** *Mr. Wertheimer exhibited several modifications of the "Automaton Calculator," invented by Dr. Roth, and exemplified their practical use, by performing with great rapidity calculations in all the simple arithmetical rules.*

The machine for performing addition, multiplication, and subtraction, consists of a narrow oblong box, with a metal plate on the top, which is divided into nine indexes, and semicircular notches; the first six, from left to right, serve for the numbers, from hundred thousands to units; the three last are appropriated to shillings, pence, and farthings. Round each index are engraved figures, from 0 to 9, and the semicircular notches contain teeth, which correspond with the figures. Under each notch is a circular hole, and in these the result of the calculation appears at the end of the operation.

The mode of using the instrument is very simple; it is performed by inserting a metal point in the teeth of such figures in the indexes as are required to be brought into action, and drawing each one down to 0; the result is then read off from the circular opening in which it appears recorded.

The machine for division, and for performing more complicated calculations, is circular, and much more bulky.

Mr. Wertheimer showed the interior of the machine, and explained that its action was produced by a simple combination of toothed wheels and springs, so contrived as to render an error in the result impossible.

He then gave a short historical sketch of the various attempts at constructing calculating machines, noticing:—

First, the Abacus of the Romans, and the calculating boxes of the Chinese and the Russians.

Secondly, the calculating rods, two of which, being each divided into equal parts, from 0 to 100, were used for addition of two numbers, by placing the first number on one scale opposite 0 on the other, and opposite the second number would be the result of the calculation. The operation of subtraction was directly the reverse of that for addition. Several modifications of these scales were introduced by Perrault, in 1720; Poetius in 1728; Perègre in 1750; Prahl, in 1789; Grüson, in 1790; and Güble in 1799.

Thirdly, the inventions of Napier, the "Virgulæ Napernianæ," the "Multiplicationis promptuarium," and the "Abacus Arcalis," in 1617; then the plans of Caspar Scott, in 1620; Demeam, in 1731; Lordan, in 1798; Leopold, Petit, and others.

Fourthly, the improvements in Gunter's Scales, by Wingate, in 1627, which were modified by Milburne into the present sliding rule, in 1650, and still further improved by Seth Partridge, in 1657.*

These contrivances gave rise to the formation of the more important machines of Blaise Pascal, in 1640; Sir Samuel Moreland, in 1666; Lepin, in 1725; Hillorin, in 1730; and Gersten, in 1735; this latter was presented, like that of Leibnitz, to the Royal Society of London.

Several other attempts at calculating machines, most of which were failures, were then noticed, until 1821, when Mr. Babbage undertook his large machine, which he completed as far as forming a progression up to five figures.†

Upon these examples Dr. Roth is stated to have worked, and the result is shown in the simple instrument which he has produced, and which has been extensively used in public offices and banks, where it is found to be very useful.

It has been adopted as a counter, or register of the number of strokes, or of rotations of machines, and answers very well for that purpose.

"Description of a Bridge across the river Shannon at Portumna." By *Thomas Rhodes, M. Inst. C.E.*

This paper describes a bridge which has been erected across the river Shannon at Portumna, to form a communication between the counties of Galway and Tipperary, at the spot where a timber bridge formerly stood.

The present structure is composed of straight cast-iron girders, resting upon piers formed of timber piles, leaving thirteen openings of 18 feet 6 inches span each, between the Tipperary shore and Hayes Island, and twelve openings of the same span, between the island and the outer pier of the swivel-bridge, which is 40 feet 6 inches span, and is close to the Galway shore. The total length of the bridge is 558 feet 6 inches, exclusive of the width of Hayes Island, upon the centre of which are placed the toll-house, and a stone obelisk, commemorative of the building of the bridge, under the direction of the Commissioners of the Public Works for Ireland. The width between the balustrades is 17 feet.

The ashlar work and rubble masonry of the abutments, the pier of the swivel-bridge, the toll-house, and the retaining walls, are

* For a previous description of this invention see *Mech. Mag.* No. 951.

* Vide "Treatise on the Steam Engine," by John Farey, vol. i., p. 536.

† This machine is now in the Museum of King's College, London.

of Portumna limestone, and are built with hydraulic mortar, the lime of which was burnt from the same description of stone as that used in the building.

In the foundations, the sheeting piles are of red pine; the bearing piles of beech and larch; and the main piles and waling pieces for supporting the roadway girders are of Memel timber.

The earth having been excavated down to the solid strata, of sufficient space for the abutments, retaining walls, counterforts, and the foundations for the swivel-bridge (the latter being done by means of two coffer-dams); the foundation or bearing piles 8 feet long and 10 inches in diameter, were driven 4 feet apart, from centre to centre, along the foot of the abutment walls, and a capping of Dantzic timber 12 inches by 6 inches was spiked to them; the whole area of the foundation under the walls and counterforts, was covered with a thickness of 12 inches of concrete, composed of six parts of clean gravel and sand, and one of lime. A course of flag-stones 7 inches thick, was then laid and the walls were built, being backed with well pounded clay from the excavations, as the masonry proceeded; the space between the retaining walls was then filled to the underside of the roadway and levelled to receive the broken stone or metalling.

The ashlar work and backing were laid flush in their respective kinds of mortar, and every course was well grouted, so that the whole might become one solid mass. The mortar was made of Portumna lime, in the proportion of two parts of sand to one of lime, fine sifted and wrought in a pug-mill.

The main piles, 14 inches square, (after being Kyanized,) were driven at least 9 feet into the solid ground, at distances of 20 feet apart from centre to centre, and were cut off level, at the height of 9 feet 6 inches from the surface of the summer water-level. The caps were then tenoned upon them, all the joints having in them a sheet of patent felt saturated with boiled tar.

The cast-iron girders are 20 feet long, 17 inches deep, and 1½ inch thick, with a flanch at the top 8 inches wide, to receive the roadway plates, and another at the bottom of 4 inches in width. They are supported by chairs cast in the caps, and are secured by distance pieces. The roadway plates are ⅞ inch thick, secured by bolts and nuts, and the joints made with iron cement. Cast-iron fascia plates are screwed to the outside girders, to carry the wrought-iron balustrade.

Previously to leaving the manufactory of Messrs. J. and R. Mallet (Dublin), where they were cast, all the girders were proved, by placing them on supports 20 feet apart, and suspending from the upper edge a weight of 12 tons, which was made to traverse from end to end of the girder, in order to subject each part to the same test.

The swivel-bridge is composed of two leaves, with a clear opening of 40 feet for the navigable channel. The ribs forming the arched part of the bridge, from the abutment to the centre, are each cast in one piece, with flanches at the radiating line, to which the cross tie-plate is bolted; a continuation of each rib is carried across the upper frame, to the circular tie-plate at the end; these have also flanches to correspond with those of the arched ribs, and are bolted together; the flanches on the upper edge of the ribs, receive the roadway planking, which is of British oak 2½ inches thick. The leaves turn on case-hardened iron rollers, and require about 15 tons of ballast, to balance them.

The construction is minutely described, with the quantity of materials of all kinds employed, the dimensions of the several parts of the masonry, the timber work, and the cast and wrought iron work.

The specification, the form of tender, and the prices of the various portions, are given, and it is stated that the total cost of the bridge, including the extra work, superintendence, law expenses, &c., was £24,131 8*s*. 1*d*.

Extracts from the journal of Mr. Smith, the superintendent of the works, give the dates of the commencement and termination of the several parts, from which it appears, that the first stone of the abutments was laid on the 13th September, 1838, and that the whole structure was finished on the 13th January, 1842.

The paper is illustrated by three very complete drawings, copied by Mr. T. H. White from the original designs by Mr. Rhodes: giving the general plan and elevation of the bridge, with enlarged details of all parts of the structure, including the coffer-dams, &c., used in the construction.

GALVANIC CLOCKS AND WATCHES.

Sir,—I observe an account of a galvanic clock in your journal (No. 1084), in which it is stated that a spring is the motive power, and a galvanic battery is employed to magnetize and demagnetize, and consequently wind up the spring at any time as intended; so that the clock will continue to go as long as the action of the battery continues to prevent the spring from losing its elastic power. I beg, Sir, to state, that I have invented clocks upon this principle eight months ago. My first method was to make the battery the

power (I mean its gravity or weight), and its magnetic power to raise the battery to the same point again; consequently the battery has two powers, the one to give the first impulse to the clock, and the other to wind up again, in order to continue the motion. It appears to me probable that the time is not far distant when watches will be actuated by the same principle. My last improvement in galvanic batteries has rendered them so simple and portable as to be carried in the pocket, and to continue the deposition of metals, just the same as when not in the pocket; but this arrangement I have not as yet made public. Your insertion of this will very much oblige, yours, &c.,

J. EDEN MACDOWALL.

London, May 23, 1844.

COWAN'S EQUITABLE GAS-METER.

Sir,—In your Magazine for May 11, No. 1083, there is a letter from Mr. Chetwin, of Preston, commenting on my new drum for gas-meters, wherein Mr. Chetwin states that he invented a drum upon the same principle five years ago, but, on account of its imperfection, laid it aside.

The letter referred to evidently shows that Mr. Chetwin (with whom I am not all acquainted) has given much consideration to the gas-meter question. His remarks, however, must be considered as referring to his own imperfect invention, rather than to mine, which, I believe, he has not had an opportunity of proving.

Mr. Chetwin is right in stating that the variation of measurement in the old meter arose from the rise and fall of the water in the body of the drum, and also in the inlet and outlet of the meter. But, Sir, I never pretended to do away with the *small variation* arising from the water sealing the inlet, and outlet—that on the inlet being so trifling as not to be taken into account at all, and the other being at the *very extreme*, and, even according to Mr. Chetwin's own account, under 2 per cent. I do most distinctly say that no variation of measurement can take place in the body of the new drum, it being the great cause of the *large* variations of the old gas-meters.

I am happy to observe that in your valuable Magazine you are ever ready to patronize and encourage any improvement which may remove defects, and gradually lead to perfection; this in human affairs is all we can expect, and certainly much wiser than throwing a thing aside merely because it is not absolutely perfect.

My meter, with the new drum, is called the "Equitable Gas-meter;" and sure I am that, if the once famous Flower, or even Dr. Jones, had fallen in with it, we never should have heard anything of the variation of gas-meters from the rise and fall of water in the chambers.

Requesting the insertion of this reply, but with no intention to trouble you again in this matter,

I remain, Sir,

Your most obedient servant,

WILLIAM COWAN.

Glasgow, May 27, 1844.

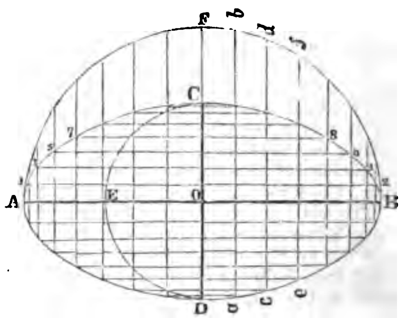
NEW METHOD OF DESCRIBING ELLIPSES.

Sir,—Having discovered a new method of describing ellipses, I take the liberty of enclosing a description of it, together with plans for the construction of an instrument for drawing ellipses on this principle. I am, Sir, yours, &c.,

ROBERT B. COUSENS, Engineer.

Grosvenor-street, Commercial Road East.

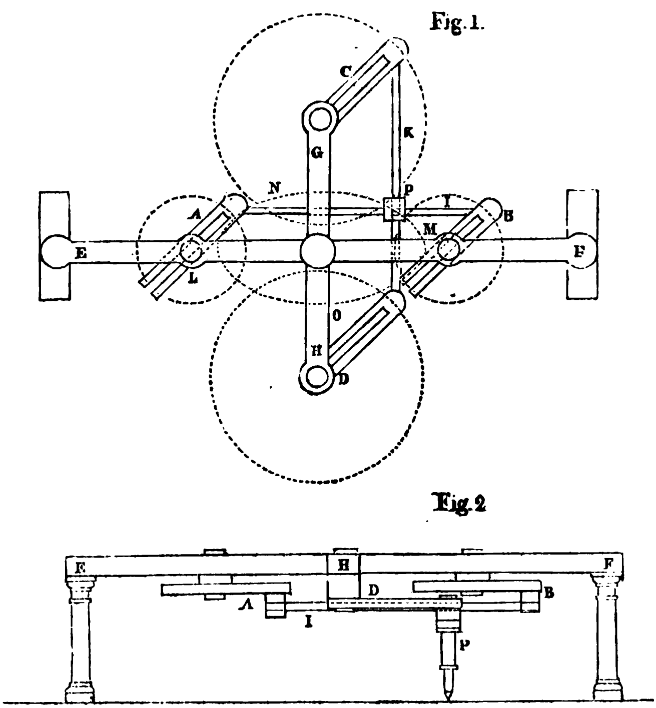
Description.



Let A B C D, in the above diagram, represent the transverse and conjugate diameters of the ellipse required. With the radii O C, or O D, and O A or O B, and centre O, describe the semicircles C E D and A B F, which divide into any like number of equal parts. Through the points of division in the smaller semicircle draw lines parallel to A B, as 1, 2; 3, 4; 5, 6, &c.; and through those of the larger one draw lines parallel to C D, as *a*, *b*; *c*, *d*; *e*, *f*; &c.; the intersections of those lines will be points in the circumference of the ellipse.

An instrument for describing ellipses may be constructed on this principle in the following manner:

Fig. 1. Fig. 2.



A B C and D, figs. 1 and 2, are cranks, revolving on axes attached to the cross E, F, G, H, and connected in pairs by the rods I and K. P is the pencil socket, the head of which is drilled cross-wise, one hole somewhat above the other, to allow the rods I and K to pass through it.

If the four cranks be made to revolve at the same time, the cross bars I and K, by sliding through the head of the pencil socket, will cause the point to describe an ellipse, whose semi-transverse and conjugate diameters are equal to the throws of the cranks; for the bars, in every position of the cranks, represent the cross lines in the first diagram, and as the intersections of those lines are points in the circumference of the ellipse, so likewise will be the crossing points of the bars; and as the pencil socket, from the manner of its connexion with the bars, must always be precisely where they cross each other, the pencil must of necessity describe an ellipse.

The cranks must be made in such manner, that their throws may be increased or diminished according to the dimensions of the ellipse required to be drawn. If the throws of both pairs of cranks be equal, the instrument will describe a circle—if one pair have throw, and not the other, a straight line will be drawn—if neither pair have throw—a point. The dotted circles in fig. 1, represent the orbits of the cranks, when *set* to produce the ellipse L, M, N, O.

The cranks may be made to revolve in the same time and direction by means of fine teethed wheels and rollers, one fixed to each crank and axis, and the fifth having its axis in the centre of the cross.

THE TRESAVEAN ENGINE FOR RAISING AND LOWERING MINERS.

At a meeting at Redruth on the 16th ult., of the Miners Society (an institution recently established in Cornwall for promoting and protecting the interests of its mining population) Captain Nicholas Vivian made an interesting Report on the engine for raising and lowering miners at Tresavean, which our readers may remember obtained the premium of 500*l*., offered for the best contrivance of the sort, and of which we gave a full description in our Journal, vol. xxxix., pages 112 and 238. We extract from the *Mining Journal* the following account of this portion of the proceedings of the meeting :—

Captain Nicholas Vivian stated that he had been accompanied in his visit to Tresavean by Captain Charles Thomas and his (Mr. Vivian's) son. He walked to Tresavean, and went down to the bottom of that mine, and walked home to Camborne the same day. He did it purposely, and when he stated that he was as well when he got home as when he started, they would understand something of the advantages of the contrivance. Had he attempted to go down into the mine by the barbarous mode of ladders, most of those present would say that he must have had a bed at the bottom, but he could have gone down ten times without feeling any fatigue from it. The depth of the adit was forty fathoms, and of the man engine below the adit 248. Altogether the depth of the engine was 288 fathoms. They went down there and saw a good lode. (Hear, hear.) The steam-engine has a 36-inch cylinder, double power, 6-feet to the stroke, makes five revolutions to one of the connecting wheels. The rods are balanced as nearly as can be against each other, and the weight taken off the cranks as much as possible by three balance-bobs each—two bobs at surface, two near the bottom of perpendicular, and two on the underlay. Size of rods 9 inches at the top, and 7 inches square below, 12 feet stroke—ascent and descent about 70 feet per minute. Consumption of coals in twenty-four hours, 12 cwt.; grease, 4 lbs.; oil, 1 pint; 400 men, at an average of 260 fathoms, sent up and down in twenty-four hours; or say, 28½ tons at 260 fathoms, or a duty of 7,000,000 lifted one foot high by virtue of a bushel of coals (94 lbs.) It should be understood that the engine is at work only about six hours in the twenty-four, and that one-half of the coals, and more, is required to keep up the temperature, and at least one-third of the power expended in friction. This 28½ tons was, before the use of the man engine, raised purely by the physical exertion of the men, which will be found about 110 tons lifted one foot high by each man. The engine and rods seem perfect; the machine was a beautiful one, and he did not see how it could be improved. The journey to the bottom is performed in twenty minutes without risk or danger, requiring just sufficient vigilance to keep a man awake, without the least fatigue. By the barbarous system of ladder roads, a journey to the bottom of the mine and up every twenty-four hours, seems quite as much as the strongest man ought to perform consistently with his health, so that all the labour at the bottom of the mine is *fairly* gained. It appeared that the adventurers had also benefited, for they were now giving 16*l*. a fathom for the working of ground that used to cost 24*l*. or 25*l*. Water is carried to every level in this mine by pipes, with a reservoir in each shaft plat, where the men may have a constant supply of pure granite water, an advantage not easily estimated. Preparations are nearly completed for lighting the man engine shaft with gas; and when that is done, the oldest man or woman, if able to walk at the surface, might go to the bottom of Tresavean; and he should have no hesitation in taking down his uncle, who was ninety-two years of age, if he were not deaf. In conclusion, Mr. Vivian said that they had had every assistance and attention, for which they were greatly obliged, from Captain Jennings.

Mr. Garland said that one of the objects of the proposer of this committee, was to ascertain whether the machine would tend to increase the men's labour, and this it unquestionably did not. A man could go down by it, and do a good hard day's work, without any fatigue.

Mr. Enys said that the statement of one of the men to him was that it was easier to come up the mine than to go into bed, for in coming up he had only to move himself from one side to the other, whilst in getting into bed he had to lift himself.

Capt. C. Thomas added some interesting information to Capt. Vivian's, relative to the economical part of the question. Taking the expense of erecting the engine, allowing for wear and tear and the cost of working it, and keeping it in repair, he thought the monthly expense would be about 45*l*. If they raised 300 men 300 fathoms, it would cost about 1¼*d*. a day for each man, and if a man were to be paid for raising and lowering himself 300 fathoms, it would require two hours to do so, and be very hard work, for which he ought to be paid at least 6*d*. an hour. But say at least 9*d*. for the two hours, and the cost was only one-sixth part by the engine of what it would cost the man to do it by himself. Thus, on the common principle of economy, it should

be introduced into every deep mine.—The Chairman: Perhaps all may not have shafts convenient for it.—Captain Thomas said there might be circumstances insurmountable, but such an object should be kept in view now in every mine, and it would be consonant with all the principles of economy to do so. If they could raise the stuff from a mine for one-third the usual expense, they thought they were doing a good thing; but if they could raise the men for one-sixth, that ought to be considered a much greater. Mr. Enys said that in going down they might always make a larger shaft at a very small additional cost, and he hoped that would be kept in view.

IMPROVED BLAST-FURNACE HEARTH.

[From a letter in the *Monmouthshire Merlin*.]

"I forward you a brief sketch of a blast-furnace hearth, which I have lately seen at the works of the British Iron Company, near Pontypool. It exhibits some variation from the usual mode of construction, and appears to me to be worthy a notice in your columns. The hearth and boshes of blast-furnaces are generally formed of a coarse grit, or conglomerate, popularly known as the 'plum pudding stone.' These are procured in blocks of enormous size, and, when fixed in their place, jointed with fire-clay, in order to resist the action of the intense heat to which they are exposed. These stones having frequently to be brought from a considerable distance, and the dressing also requiring much labour, the expense attending this mode of construction is, consequently, very great; and, of late, some hearths have been built of fire bricks. This plan is, of course, much more economical as regards the first construction, but is not so durable as the older, and more popular method. Now, in the case to which I allude, as an improvement on both of the above-mentioned modes, the durability of the former seems to be attained, while the expense of erection is even less than in the latter; and this is effected by the use of common stones, and of ordinary size. The stone employed for the purpose was millstone grit, which was selected with as little silex as possible; and the hearth was built in the following manner:—the bottom was first formed with burnt bricks 2 ft. 1 in. long, 9 inches wide, and 4½ inches thick, laid on their ends, and cemented with fire-clay. Over this pavement a bed of sand was placed, in which the first course of stones, forming the face of the hearth, was laid—these stones being rough polled, and the joints well rammed with sand; and in this manner the mason-work was continued to the top of the hearth. The stones were used without any attention to their size, and perfectly rough, the hatchet end of the hammer not even being used to dress them, this plan being pursued, I should suppose, with the impression that the cinder on which the furnace was 'blown in,' would adhere better to the sides of the hearth, in consequence of such roughness. The outer casing of the heart was formed of fire-bricks, laid in fire-clay. The dimensions of the hearth are as follows:—At the bottom, internally, 4 feet square, and at the top, 5 feet 8 inches, the batter in the sides being 1½ inch to a foot, and the extreme size of the hearth 12 feet square. The furnace was worked with blast-furnace cinders for about a week, and has answered extremely well, although it was the impression at the time, even of a very intelligent man engaged in its erection, that the plan would not be attended with success. The opinion, indeed, was, that no cement having been used in the work, the stones being simply bedded in sand, they could not possibly adhere together, or, to use the words of the person above alluded to, would all 'swim about' in the fiery metal. The cinder employed in the first instance has, however, undoubtedly had the effect of forming a 'glaze' over the hearth, and cementing the masonry into one firm and compact mass. Permit me to make one more observation, in conclusion. I have frequently heard it remarked that blast-furnaces are sometimes a considerable period before they arrive at a good workable condition—in short, supposing the furnace be not constructed upon correct principles, it will not work to a good yield, until it has, by its own efforts, so modified the form of the different parts, as to adapt them to the peculiar circumstances of the case, by adding in one place, or removing an obstacle in another. Taking a hint, then, from these facts, would it not be advisable—at all times, whenever possible—to make an examination of a furnace which has been found to answer well, at any particular work, and to adhere strictly to the form which it has assumed in the progress of working, as that which is best adapted to the nature of the materials employed?"

DEROSNE'S SUGAR PATENT—EXTENSION OF TERM.

Judicial Committee of Privy Council.

May 20.

The Solicitor-General (with whom was Mr. Godson,) was heard on application for an extension of the petitioner's patent for a chemical invention of considerable importance in the refinement of sugar. Mr. Waddington appeared on behalf of the Crown.

The patent had been granted in 1814. M.

Derosne was a French gentleman, very eminent for his chemical science, and had been 40 years engaged in scientific experiments. By his invention and patent he had not himself gained, clear of expenses (principally law charges), more than about 5,000*l*., and it was urged on his behalf, and in favour of the extension, that very great credit was due to him, that the public had been very considerably benefited, and that he had a fair claim to be more amply rewarded by having conceded to him the extension now sought. In 1812, M. Constant obtained a patent for an invention for facilitating to some extent the refinement of sugar. In 1813 Howard's patent was granted for an invention which, though there were several other improvements, consisted principally in the boiling *in vacuo*, and this became immediately in such almost universal use as to have produced to the inventor and those claiming under him nearly half a million of money. M. Derosne's patent (in 1814) consisted principally in the application of animal charcoal as a filter, in a way in which it had never been applied before, whereby a saving of 2*d*. per pound in refined sugar was gained by the public, and the quantity of ox blood necessarily used in the process was very considerably reduced. It appeared that the public were thenceforward enabled to consume sugar equal to the double-refined prior to this invention at little more than the former cost of the coarsest quality, and that what before cost 10*d*. per pound, might now be had for 8*d*. Charcoal had been used before, but was pulverized only and thrown into the sugar *en masse* (as isinglass with coffee) to take off all the impurities and colouring matter. By Derosne's invention animal charcoal only was used, and this was reduced into an impalpable powder, and placed upon a sort of colander, and then covered over with a suspended blanket. By this the impurities and colouring matter were cleared away, and the animal charcoal thus used admitted of being thoroughly cleansed and used again and again. The patentee had been obliged to have an agent in England, and to go to Jamaica, and, although he had granted many licenses and received considerable sums, had not netted more than the sum above stated.

The SOLICITOR GENERAL considered that it was an invention of very great importance, and hoped that their Lordships would be willing to extend to the inventor the benefit of it.

Mr. WADDINGTON, for the Crown, stated that he felt he should be fully performing his duty in leaving the matter in their Lordships' hands without occupying their time with any observations.

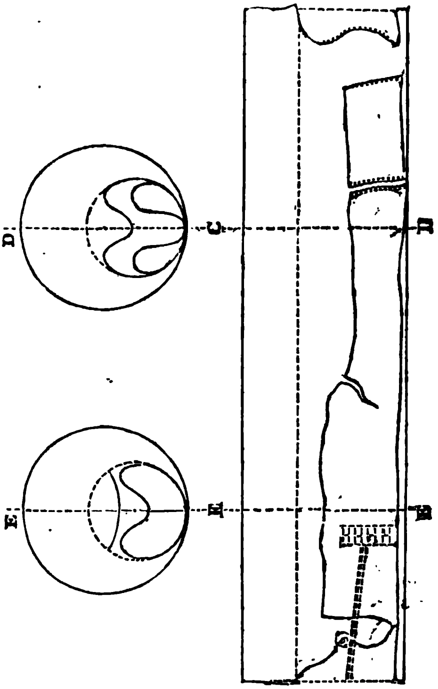
Lord BROUGHAM briefly delivered the judgment of the Court. Their Lordships laid down this rule—that, first, there must be some invention; and secondly, there must be a benefit to the public, and a very considerable one, to warrant the extension of a patent. Here the benefit to the public did appear certainly very considerable, and out of proportion to the originality of the invention, and very considerable profit had accrued to the public, whilst the inventor had not profited very extensively; their Lordships thought it right therefore that there should be a larger extension than they would concede under ordinary circumstances. Their Lordships granted the extension for six years from the time at which the former patent would, in this present year, have expired.

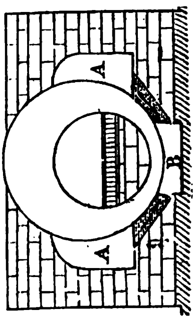
STEAM BOILER EXPLOSION AT LYONS.

Sir,—If the following account of a steam boiler explosion which happened here on the 10th inst., should appear fitting for your useful Magazine, you may rely on its correctness, as I was the first person who made a minute inspection of the place after the explosion. The enclosed plan of the boiler after the explosion is from actual measurement, the dotted lines showing the boiler as it was before the accident: the drawing is one-eighth of an inch to a foot.

The dimensions of the boiler are as follows:—length, 28 ft. 4 in.; diameter, 6 ft. 6 in.; inside tube, length, 28 ft. 4 in., diameter, 4 ft.; thickness of plates, three-eighths of an inch; ends of boiler flat; length of grate, 5 ft. 4 in.; breadth of grate, 4 ft. The boiler was built in brickwork, with side flues, A A, and one, B, running along under the boiler to the chimney.

The inside tube gave way at both ends at the same time, but the rent at the after end was much the largest, so that the boiler was thrown forward about 2 feet, and lifted up about 6 inches. One of the fire bars was thrown out, and broken in three pieces. A wall 20 inches thick, about 12 feet distant from the front of the boiler, was thrown down, and the stones projected to a great distance. A large stone, that served as a seat against the wall, and was 3 ft. 3 in. long, 2 ft. broad, and 1 ft. 8 in. thick, was thrown 15 yards from its place into a plantation of poplar trees. At 30 yards distance, three trees of 7 inches diameter were cut down; at 75 yards, two trees of 8 inches





diameter were broken. At the 75 yards distance there is a bank about 6 feet high, which stopped the greater part of the projectiles. But the muddy water was visible on the trees at a distance of 130 yards, and broken bricks were thrown to 200 yards distance. At the back end of the boiler there is a large flour mill, separated by a high wall 16 inches thick, which was blown against the wall of the mill, distant about 65 yards, breaking the iron railing of a stair, and lifting the roof of a room. Some tiles were torn from a roof, and thrown to a great distance; the roof was 36 feet high, and 70 yards distant from the boiler. The water was thrown over the mill to a distance of 200 yards. Two boys were scalded, and died a few hours afterwards. The reason why so few lives were lost was, that the explosion took place during the dinner hour.

I examined the inside of the boiler very minutely, and could find no appearance of the plates being heated from want of water. But I found that the plates were made of very bad iron, and that they were not uniform in thickness. The valves were very small for the size of the boiler, being no more than 3 inches in diameter; there are two on the boiler. The fire tube was likewise repaired in some places, as it had served as a cylindrical boiler for some time. The proprietor had been prevailed upon to have a shell put on it, and made something like the Cornish boilers. It produced steam to drive two engines of 16 and 25 horse-power. The small engine was driving hammers for tilting steel, and the other turned the rolling mill; the tilt hammers were at work when the accident took place. The cause of the explosion may be traced first to the fireman having put on an extra charge of coals before going to dinner, which produced more steam than could escape freely at the valves; second, to the intermission of the steam-engine—at one time running 35 strokes a minute, and then brought down to 10; and, lastly, to the bad quality and want of strength of the plates, and the great diameter of the tube. The valves were loaded at 45 lbs. on the square inch.

One of the worst features in such cases is, that the public has nothing to do or say about them. There is no jury named to enquire into the cause of the accident. The newspapers give a *left-handed* account of it, and it is soon forgotten.

We are beginning to have our *fast boats* here, as you have on the Thames and other rivers, and high-pressure steam is the order of the day in this quarter; so that there is little doubt but steam boiler accidents will be more frequent here than in times past. On the 8th inst., the boiler of a small high-pressure boat, called the *Laveret*, plying with

passengers on the Saone, was rent, and killed the engineer and one of the firemen, scalding the other dreadfully. The water was allowed to become low in the boiler, and the engines were beginning to turn when the accident took place.

I have just received your Magazine for March, and at page 195 I find a flat denial by Mr. Ham of the efficacy of common salt in hindering incrustation in steam boilers. In my communication I should have done well not to have supposed the feed water to contain sulphate of lime, as the incrustation in land boilers fed with fresh water is invariably *carbonate* of lime; so that we have only to guard against the carbonate, and not the sulphate of lime. But then Mr. Ham would not have had the pleasure of *proving* to the world that common salt will *not* hinder incrustation in steam boilers, and that the sulphate of soda decomposes the muriate of lime. Has Mr. Ham never *dreamt* that the sulphate of soda, and the muriate of lime have dwelt together for ages, without mutually decomposing one another? Dr. Murray found that 7,291 grains of sea water contained 25·6 grains of sulphate of soda, and 5·7 grains muriate of lime, and that 7,291 grains of water from a saline spring contained 3·7 grains of the sulphate of soda, and 20·8 muriate of lime. He likewise makes me say, that the "muriate of soda decomposes the sulphate and carbonate of lime, rendering them soluble as *muriates!*" Mr. Ham does not quote correctly, which is unfair. With regard to sea-going boilers, in which there is often too much salt, I have said nothing. I hope some of your numerous readers have, ere this, given a fair trial to common salt, which will cost less than a guinea, and set the matter at rest, by publishing the results in your Magazine.

I remain, yours truly,

WILLIAM HALL.

Lyons, May 25, 1844.

ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

DAVID EVANS, OF COLESHILL-STREET, EATON-SQUARE, ENGINEER, *for certain improvements in sweeping and cleansing chimneys and flues, and in increasing the draft therein, and in preventing the same from smoking.* Patent dated, Nov. 2, 1843; Specification enrolled January 2, 1844.

1. These improvements, so far as they relate to the "sweeping and cleansing of chimneys and flues," consist in a modification of the Scotch rope and brush method. To the upper part of a metal chimney pot there are attached four small upright pieces of metal, supporting a hollow pyramidal top or cowl, within which there is fixed a metallic block and pulley. A wire rope is passed through the block, and is of such length, that both ends reach to the bottom of the chimney, where, when not in use, they are attached to hooks fixed for that purpose. When proceeding to sweep the chimney, a hempen rope is tied to one of the ends of wire rope, and by means thereof drawn up the chimney and round the pulley at top—the wire rope not being used at all during the actual operation of sweeping. A circular brush is then attached to the hempen rope, and drawn up and down the chimney until it is sufficiently swept, when the brush and hempen rope are removed.

2. The improvement "in encreasing the draft" of chimneys, and "preventing the same from smoking," consists chiefly in covering the opening at the back of the stove for the passage of the smoke into the chimney with two perforated slides (similar to those employed in locomotive engines,) by moving either of which, more or less to one side, the vacant spaces in the one plate can be more or less covered by the solid portions of the other, and by this means the degree of draft regulated at pleasure, or the communication with the chimney be altogether cut off. The fender is also to be perforated at bottom to admit air to pass down into channels beneath, by which it is to be conducted into the under part of the fire-grate.

The claim is—1st. To the sweeping apparatus as described, in the general arrangement of the parts of which the same consists—the patentee disclaiming the parts individually; and 2nd, to the arrangements described for supplying chimneys with air, and preventing back smoke, and also the plan of supplying atmospheric air to fire-grates by air drains in conjunction with the fire-fender.

EDWARD BUXTON, OF BASINGHALL-STREET, MERCHANT, *for improvements in spinning wool, cotton, and other fibrous materials.* (Being a communication from a foreigner residing abroad.) Patent dated November 16, 1843; Specification enrolled May 16, 1844.

The subject of this patent is a particular method of treating the cardings and rovings of wool and cotton, or mixtures of cotton with other fabrics, whereby the thread which is spun from the same is stated to be made rounder, of more uniform thickness, and

stronger, than when prepared according to the modes now in general use; and whereby also the workers and spinners are less liable to be injured in health from the dust and fine particles thrown off during the process of manufacture. The wool or cotton, as it passes from the carding machines, is to be completely saturated with moisture, for which purpose it is conducted under a series of bars of metal immersed in water, and from thence through a pair of rollers, also under water, after which it is led to a second, or drawing pair of rollers. Although the patentee considers this the best method of accomplishing the object in view, he does not confine himself to it, but claims generally, 1st, The saturating with water the cardings of wool, as they come from the carding machines. 2nd, The saturating with water the rovings of wool previous to being spun. 3rd, The saturating the rovings of cotton and other materials with water, in passing from the carding machines. And, 4th, The saturating the last-mentioned articles with water previous to being spun.

James Smyth, of Peasenhall, Suffolk, Machine Manufacturer, *for improvements in the construction of drills for sowing grain, seeds, and manure.* Patent dated November 16, 1843; Specification enrolled May 16, 1844.

The *first* of these improvements consists in the substitution of iron for wooden cheeks or sides in the framework of drilling machines. The boxes for containing the seeds have their ends also made of thin iron plates instead of wood.

The *second* consists in arranging and proportioning the distance of holes in the framework for the reception of the bearings of the different sizes of wheels and pinions requisite for giving motion to the seed and manure cups (afterwards described) according to the nature of the seed or manure to be dispersed on the ground, and to the velocity of the machine.

The *third* is an improvement on the manure or seed box in common use. A set of cups or scrapers are attached to arms radiating from a spindle passing through the middle of the box, and this spindle is set in motion by a toothed wheel fixed on its end, and driven by another toothed wheel attached to the nave of one of the carriage wheels. As these cups revolve, they are so placed that they lift up a quantity of the manure or seed in the lower part of the box, and as they come up toward the highest point in their revolution they empty themselves into a hopper, and so disperse their contents. When seeds of very different kinds are being sown together, such as clover and grass, instead of having the two mixed in one box, whereby, from the great differences in their weight, they might be unequally sown, the patentee uses two boxes, and two sets of revolving cups, but discharging their contents into the same hopper.

Thomas Liddell, of Newcastle-on-Tyne, Engineer, *for improvements in apparatus for preventing explosion of steam-boilers.* Patent dated February 21, 1844.

A malleable iron float, weighing 85lbs. and having a buoyancy equal to 25lbs., is placed within the boiler; to this float is attached a vertical brass rod, which passes through a stuffing-box in the top of the boiler, through a hole in a horizontal lever which is attached, by means of a connecting rod, to the ordinary safety-valve. Should the water in the boiler sink below its proper level, the float sinks also, until a stop on the top of the vertical rod comes in contact with the horizontal lever, and gradually opens the valve, when the steam contained in the boiler escapes. On the water rising, the float ascends, and the valve drops into its seat.

George Gwynne, of Putney, Gentleman, and George Ferguson Wilson, of Belmont, Vauxhall, Gentleman, *for improvements in the manufacture of candles and in apparatus for, and processes of treating fatty and other substances for the making of candles, and other uses.* Patent dated, November 16, 1843; Specification enrolled, May 16, 1844.

The apparatus described in this specification is a close still, with appendages suitable for the distillation of tallow, lard, oil, and other fatty substances, excepting always cocoa-nut oil, when intended to be used in the manufacture of candles. The body of the still is made of copper, varying in thickness from three-eighths of an inch at the bottom, to one quarter of an inch in the upper part. It is filled by means of a pipe which passes through the top of the still, down nearly to the bottom, where there is a small round cavity formed into which the end of this pipe dips. After the tallow, or other substance, has been melted by the application of heat to the outside of the still, steam is diffused in numerous small streams through it, by means of a pipe which leads from a boiler to the still, and passing downwards terminates at the bottom of the still, in a perforated coil. Or, instead of steam, carbonic acid may be employed; but the former is preferred. The products of distillation are conducted by a third pipe, to a separate vessel where they are collected. All these pipes are furnished with stop cocks or valves, so that when the finer parts of what is being distilled has come over, by shutting off the communication with the

receiver, and leaving only the supply and steam-pipes open, the pressure of the steam on the surface of the residuum accumulated at the bottom forces it to raise up the supply pipe, whereby the still is cleansed for another operation.

The various purposes to which the patentees propose to apply this apparatus, will be seen from the claims with which their specification concludes, which are as follows:—1st. The treating in manner above described tallow, lard, oils, and other fatty substances, (excepting cocoa-nut oil,) when intended to be used in the manufacture of candles. 2nd. The similar treatment of these substances, when used for the manufacture of soap. 3rd. The application of steam to the distilling of these substances. 4th. The application of carbonic acid for the same purpose. 5th. The manner of collecting the products, and cleaning out the still. 6th. The re-distilling (by means of the apparatus described) of the acids of stearine, with the atmospheric air excluded, after the same have been previously distilled under exposure to the atmosphere. 7th. The distillation of rosin oil by steam, the atmospheric air being excluded. 8th. The re-distilling of the residuum of a first distillation, after it has been ejected by the means before described, and then saponified.

LIST OF PATENTS GRANTED FOR SCOTLAND FROM THE 22ND APRIL TO THE 22ND MAY, 1844.

John Lee, of Newcastle-upon-Tyne, esq., for improvements in obtaining products from sulphurets and other compounds containing sulphur. Sealed. April 24, 1844.

William Scott, of Bolton-street, Piccadilly, Middlesex, esq., for improvements in the manufacture of fuel. (Being a communication from abroad.) April 24, 1844.

William Henry Barlow, of Leicester, civil engineer, for improvements in the construction of keys, wedges, or fastenings for engineering purposes. April 24, 1844.

John Dixon, of Wolverhampton, iron master, for improvements in heating air for blast furnaces, and for other uses. April 24, 1844.

William Wright, of Duke-street, St. James's, Middlesex, surgeon, for certain improvements in rendering leather, skins, or hides impervious to wet, more flexible and more durable. April 30, 1844.

John McIntosh, Glasgow, for certain improvements in revolving engines, and an improved method of producing motive power, and of propelling vessels. April 30, 1844.

Samuel Faulkener, of Manchester, Lancaster, cotton spinner, for certain improvements in machinery or apparatus for carding cotton and other fibrous substances. April 30, 1844.

William Irving, of 102, Regent-street, Lambeth, Surrey, for improved machinery and apparatus for cutting and carving substances to be applied for inlaying and other purposes. May 3, 1844.

James Murray, of the Garnkirk Coal Company, in the parish of Cadder, of Lanark, Scotland, for a new method of using and applying artificial gas made from coal, oil, or other substances for lighting and ventilating caverns, pits, or mines, or other pits, where minerals or metals are worked or extracted. May 3, 1844.

James Bremner, residing at Pulteney Town, Caithness, civil engineer, for certain arrangements for constructing harbours, piers, and buildings in water, for cleansing harbours, and for raising sunken vessels. May 9, 1844.

John Wilkie, of Glasgow, mechanic, for improvements in machinery or apparatus for working wood into the various forms for making doors, window shutters, window sashes, mouldings, flooring, and other purposes. May 16, 1844.

NOTES AND NOTICES.

The "Meteor."—A new iron steamer, to which this name has been given, has been lately completed for the Gravesend Star Company. She has been built by Messrs. Miller, Ravenhill, and Co., is 170 feet in length, 18 feet in breadth, and 9 feet 6 in. in depth; and is propelled by a pair of 40-horses beam engines (not new), constructed by the same firm, which have been removed from the Star Company's old boat the *Planet*. The boilers are tubular. Great expectations are entertained of her speed, and wagers have been offered that she will even beat the *Sapphire*, the fastest at present of all the boats on the Gravesend station; but we believe that there has not been as yet any fair trial made of her actual capabilities.

Hydraulic Railway.—It is with great pleasure we have to announce that a company is at length in course of formation to construct a railway according to Mr. Shuttleworth's invention. The line from Dublin to Sallins, being the first great artery of the Dublin and Cork Railway, is about being established as the "Grand Hydraulic Propulsion Railway;" it is 18 miles 850 yards in length, and will be completed for 99,900*l*., being at the rate of 5,400*l*. per mile, including purchase of land, 900*l*., and patent right 200*l*. per mile.—*Mining Journal.*

The Hot Blast Patent.—The *Glasgow Argus* states that the referees who have been chosen to decide the farther amount of damages to be paid by Messrs. Dixon and Dixon and Co., to the patentees of the hot blast, for their admitted infringements of their patent, have fixed the 12th of August for the hearing of this important case, when the plaintiffs are also to have an opportunity of adducing any evidence they may think fit as to the saving arising from the use of the patent process by the defenders. We learn at the same time from the *Mining Journal*, that "the experienced iron masters to whose arbitration was submitted the disputes between the hot blast patentees and the proprietors of the extensive iron works at Penydarran, Aberdare, and Tredegar, as to the amount payable by the latter for infringing the patent, have, after a careful investigation, issued a final award, finding the patentees entitled to nothing, and ordering each party to pay their own expenses!"

Immense Mass of Rock.—A mass of rock has been raised in Mr. King's quarry, Higher Bebbington, 40 feet long, 12 feet wide, and 3½ feet deep, making 1,680 cubic feet, or 120 tons. It is perfect, and without stain or flaw of any kind, and is now being cut up for use.

Messrs. Davison and Symington's Cask-cleansing Apparatus.—We are assured by the inventor of this very clever apparatus, that, instead of cleansing casks better than steam in only *half* the time, as stated by us in our last Number, it actually cleanses them much better in a *fifth or sixth* of the time. They also observe that they "do not depend in the least upon the hot air removing the mould, &c., adhering to the inner surface of the cask, as these are effectually removed by the mechanical means employed before the application of the hot air."

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1087.] SATURDAY, JUNE 8, 1844. [Price 3*d.*

Edited by J. C. Robertson, No. 166, Fleet-street.

HOSKING'S IMPROVED STEAM-BOILER FURNACE.

Fig. 2.

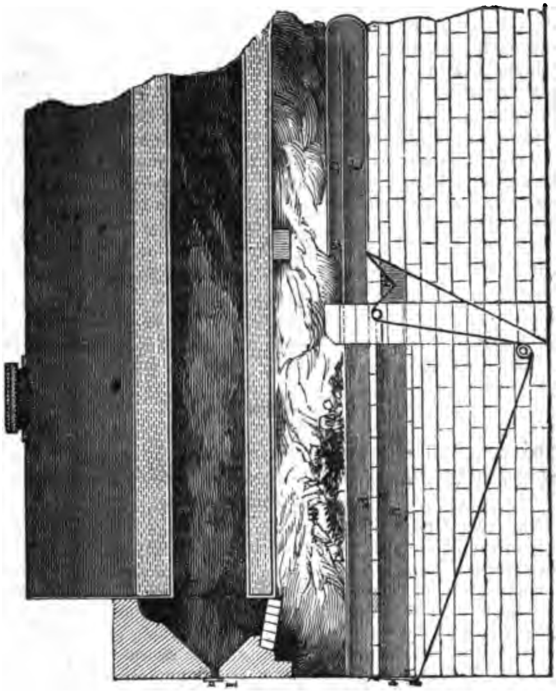
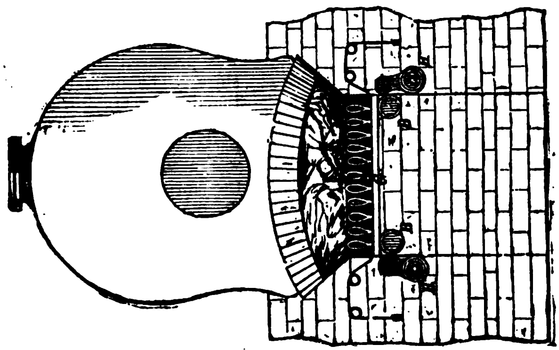


Fig. 1.



HOSKING'S IMPROVED STEAM-BOILER FURNACE.

(Registered under the Act for the protection of Articles of Utility.)

The principal object aimed at in the construction of this furnace, as of a great many others, is the prevention of smoke —an object which, now that the smoke nuisance is happily about to be abolished by act of parliament (so far, at least, as regards steam-boiler furnaces,*) must be allowed to be one of paramount importance. Mr. Hoskins, like Hall, Chanter, Ivison and others, considers that the most certain means of preventing or consuming smoke, is to ensure an ample supply of *heated* air to the blazing fuel (differing on that point *toto cœlo* from some very high authorities); and of his arrangements for that purpose, we can, at least, say, unhesitatingly, that they are among the best we have yet seen.

Fig. 1 is an end elevation, and fig. 2 a side elevation of Mr. Hosking's apparatus. A A are hollow furnace bars; B B, two air supply pipes, which run parallel with the furnace bars; C D a hot-air recess or flue, about the breadth of the furnace. The hot air being heated as it passes along through the hollow furnace bars A A, or the pipes B B, is discharged into the flue C (with which, both A A, and B B communicate) and returning along the flue D, the upper side of which forms the flame bed, is projected into the furnace through the mouth-piece E, upon which there is a grating to prevent any pieces of coal that might happen to pass over the bridge from falling into the flue D. F is an air-tight trap door for cleaning out the flue C; G is a plate forming a door to the ends of the fire-bars, and by which the amount of air admitted can be regulated according to the state of combustion; H H are doors on the ends of the pipes for a similar purpose.

I is a sight hole through which the interior of the flues can be viewed to ascertain the state of the furnace.

INSTITUTION OF CIVIL ENGINEERS.—MINUTES OF PROCEEDINGS, SESSION, 1844.

"*Description of the Bridge over the river Whitadder, at Allanton (Berwick).*" *By John Thomas Syme.*

The road which passes near the village of Allanton, and which forms the means of communication between Dunse and Berwick-upon-Tweed, and joins the main road to Edinburgh, was frequently rendered impassable by floods: in order to avoid this, Miss Boswall, of Blackadder, determined, in the year 1840, to erect bridges over the rivers Whitadder and Blackadder, for which designs were given by Messrs. R. Stevenson and Sons, C.E. (Edinburgh). Of these plans, the former only has hitherto been carried into effect.

The bridge described in the paper, crosses the Whitadder, at a point below its junction with the Blackadder; it is of two arches of 75 feet span each, with a versed sine of 11 feet 6 inches, being segments of circles of 66·89 feet radius for intrados, and 72·42 for extrados; the voussoirs are 3 feet deep at the springings, and 2 feet 6 inches at the crown. The breadth across the soffit is 22 feet 1 inch, and between the parapets 20 feet, leaving a carriage way of 15 feet.

The foundations of the centre pier and of the abutments, are on solid sandstone rock, which was found near the surface.

The whole of the masonry is of broached ashlar, except the pilasters, frieze, cornice, and impost courses, and the base and coping of the parapet.

The stone used for the greater part of the work, is a soft red sandstone from adjacent quarries, and that for the springing courses was procured from Daleky quarry, in Fifeshire. The mortar, which was made from lime got at Oxford, a village near Berwick, was composed of one part of lime to two parts of sharp river sand. Roman cement was used for pointing the face joints up to the springing courses, and above that level red oil-putty was used.

Details of the dimensions of all the parts of the structure—the forms and sizes of the

* The limitation of Mr. Mackinnon's Smoke Prevention Bill, which has recently passed the 2nd reading in the House of Commons, to *Steam boiler* furnaces is a striking, and not very creditable example of the bit-by-bit sort of legislation, for which this country is become distinguished. The only reason which the honourable mover of the bill has been able to assign for restricting his salutary measure to steam-engine workshops is, that were he to extend it to all furnaces alike—as it ought, in all justice and propriety to be—it would be opposed by so many powerful interests, that it would be thrown out altogether!—Ed. M. M.

centring—the mode of construction, &c., are given, and it is stated, that on striking the centres, the settlements that occurred were 2⅝ inches in one arch, and 2⅝ inches in the other.

The bridge was commenced August 4th, 1840, and was opened to the public March 27th, 1842. The works, including the approaches, were executed by Mr. Balfour, Balsillie, for 6,058*l.* 8*s.*; Mr. Watson being the resident inspector under the engineers.

The communication is illustrated by four drawings (Nos. 3563 to 3566), giving all the details of the construction of the bridge of two arches over the Whitadder, and of that of one arch, proposed to be built over the Blackadder, near the same spot.

"***Description of a New System of Trussed Girder of wrought and cast Iron, for Bridges.*" *By Francis Nash.***

The girders, which are described in this paper, are stated to have been much used recently in France. The structure consists of a series of isosceles triangles, whose sides are formed of flat wrought-iron bars, the ends abutting against each other, and being turned back outward, passing through and being supported by two or more rows of cast-iron transoms, (according to the required depth and strength,) which also prevent the wrought-iron bars from collapsing, or from spreading. Under this system the compression is resisted by the cast-iron, and the tension by the wrought-iron; each material in the direction of its greatest strength.

When used to form a bridge, as many of the girders as are requisite are laid upon stone or timber piers, against which they do not exert any lateral force; a timber flooring is placed either upon the upper surface, or on either of the other rows of transoms, according to circumstances, and the planking is generally covered with asphalte.

The results of experiments upon girders of various strength and bearing, as tried in Paris, by order of the Minister of Public Works, are given in detail; whence it appears that two girders of 32 feet bearing, 3 feet 2½ inches in depth, with four rows of transoms, each weighing, of cast-iron 642½ lbs., and wrought-iron 874½ lbs.; total 1517 lbs., being loaded in the centre with 8290 lbs. of pig-iron, deflected only $\frac{2}{12}$ths of an inch.

After other trials upon girders of increasing dimensions, four girders were braced together in pairs, bearing a timber floor between them, of 17 feet 9 inches wide, resting on the third row of transoms. The dimensions and weight of each girder being,—

	Feet.	Inches.
Length	74	8
Height	6	3
Weight, cast-iron 5355 lbs. ⎫ ,, wrought-iron 4845 ,, ⎭	10,200 lbs.	

The floor was then weighted in the centre with a mass of dry stone, when the relative amounts of deflection were as under:—

Weight in lbs.	Deflection produced.	
	At 18 feet 6 inches from the end.	In the Middle.
59,547	$\frac{4}{12}$ths of an inch	$\frac{7}{12}$ths of an inch.
81,602	$\frac{6}{12}$ths ,,	$\frac{8}{12}$ths ,,
103,657	$\frac{7}{12}$ths ,,	$\frac{10}{12}$ths ,,
105,863	$\frac{8}{12}$ths ,,	1 inch.
123,506	$\frac{10}{12}$ths ,,	$1\frac{1}{12}$th of an inch.

The weight was afterwards increased to 136,739 lbs., without producing any apparent difference; but the loading stones, which were of a soft porous nature, becoming saturated with rain, a further deflection of $\frac{2}{12}$ths of an inch was observed; on the return of fine weather, as the stones became dry, the girders recovered their original deflection.

The load remained on the girders twenty-five days, and upon removal, was found not to have produced derangement of any part.

In order to ascertain the effect of concussion, a weight of 9924 lbs. of iron in bars, was allowed to fall suddenly from a height of 3 feet upon the floor, which was much crushed; but no injury was sustained by

the girders, and scarcely any vibration was felt.

The paper is illustrated by two detailed drawings (Nos. 3402 and 3403.)

"*Account of the Building of the 'Wellington' Bridge, over the river Aire, at Leeds.*" *By John Timperley.*

This bridge was erected from the designs, and under the direction, of the late John Rennie; it is situated on the line of road leading from Leeds towards Wortley and Armley, and spans the river Aire at a spot where it is 100 feet wide, and about 6 feet in depth; the banks rising to between 7 feet and 8 feet above the surface of the water.

The borings, which were made to the depth of 30 feet, on each shore, to prove the ground, previously to commencing the construction, showed the strata to consist of fine sand, and then sand and gravel, with thin layers of what was supposed to be stone, but was probably hard concreted gravel, such as was afterwards found in excavating for the foundations. That on the south bank, was commenced in the middle of September, 1817. The upper part, for 6 feet or 7 feet in depth, was through fine soft sand; then came a bed of alluvial gravel, containing, at about 12 feet from the surface, black rotten wood, roots of trees, shells, bones, and horns of animals. The upper part of this gravel was coarse and open, but it gradually became finer and more compact, until it assumed the hardness of a concreted mass, resembling agglomerate, very like (except in colour) the Blackwall rock, which was taken up about forty years since, in deepening the entrance from the Thames to the East and West India Docks. Upon this stratum Mr. Rennie ordered the foundation to be placed, although it was not so deep by 4 feet, as he had originally intended.

The coffer-dam, which was formed of a double row of piles of half timbers, from 15 feet to 18 feet in length, was then completed; the best earth that could be procured for the puddle, was of so light a nature, that in high freshes the leakage became so considerable, as to render it advisable to allow the dam to fill with water, to prevent its blowing up. The details of the construction of this coffer-dam are given. It was kept dry by a steam-engine of 6 horses' power, which was fixed on the shore, and worked the pumps by an endless chain. The quantity of water was such as to keep the pumps constantly at work, night and day. The coffer-dam for the north bank was constructed after the foundations on the south shore were finished.

The details are then given of the sheet piling and wales, &c., in front of the abutments, which are each 30 feet long, by 28 feet wide, at the bottom, diminishing by offsets to 27 feet in length, by 21 feet in width, at the springing of the arch.

The abutments are built in radiating courses within, but on the faces they are horizontal; the stones were from 14 inches to 18 inches thick, cut correctly from templates, made to suit the respective courses. The lowest foundation courses were of large blocks, laid dry, and the joints well grouted; but the other courses, up to the ordinary water-line, were laid in mortar, made from magnesian limestone, got on the banks of the Aire, a few miles above Ferry Bridge: the proportions were, one part of lime, one part of clean sharp river-sand, and one part of forge scale, the whole well mixed and tempered, and used quite hot. The grout was made from the same line, and was used for all the courses, except the lowest, where Parker's cement was employed, which was also used for pointing all the face joints up as high as the water-level. In the other parts of the structure, the mortar was composed of one part of lime to two parts of sand, but that for the arch was made of equal proportions of lime and sand.

Great care is stated to have been taken with the joints, as no under-pinning was allowed, the bed of the stones being all dressed to coincide accurately. The ordinary allowance was $\frac{1}{8}$th inch for each joint, but on trying the first fourteen courses, from the springing, it was found, that 1 inch only was taken up by the joints, which gave $\frac{1}{14}$th inch for each.

The stones were laid on the south side by a movable crane, and on the north side from the end of the two-wheeled truck, (somewhat resembling a timber-carriage,) by which they were brought from the stone-yard on the south bank, along a wooden tramway and temporary bridge, extending from the south to the north shore, using either a simple sling, or sheave-blocks, for placing the stones, according to their dimensions and weight.

The construction, dimensions, and cost of this truck and of the crane are given in detail.

The abutments being finished, the piles were driven, to support the centres, which were fixed so high as to be above the freshes. The lagging was laid 5 inches higher than the proposed arch, to allow for its settlement. The six centres were framed of Memel pine, each rib containing about 370 cubic feet of timber.

The striking wedges were of seasoned oak, well greased; they were 6 inches wide and 9 inches in height altogether, the middle one, which was the largest, being the striking wedge. They were, however, found to be too narrow, for they were squeezed upwards

of an inch into the timber, by the weight of the centres and the masonry.

Prior to framing the centres, one half of the arch, which is a segment of a circle of 91 feet radius, with a versed sine of 15 feet, was laid down, full size, upon a platform, from which templates were made, for dressing the voussoirs and arch-stones; the front voussoirs were 7 feet on the bed, at the springing, diminishing to 4 feet at the crown; but the interior arch-stones, near the springing, were much wider. The arch-stones were, on an average, 3 feet long, by 18 inches thick. It was customary, in setting the stones, to saturate them with water; a thin coat of mortar was laid on the under stone, the upper one was lowered, and well beaten down while the mortar was soft; the surfaces were thus brought closely in contact with each other, and any interstices that remained were grouted, after the vertical joints had been pointed with cement.

When the arch was turned to the extent of one-third from each side, about 20 tons of stones were piled on the crown, as an equipoise for the centres, and the haunches were not loaded until the key-stones were placed.

The turning of the arch occupied four weeks; when that was finished, the haunches were completed, and the centres were eased; but it was found that the weight, which before the arch was keyed was equal to 1000 tons, had forced the wedges into the timber, so as to render it necessary to cut some of them out, which occupied three days for the first easing. A second easing took place two days after, and after a third easing the centres were removed.

During the progress of the work, the arch squeezed down about 2½ inches; in a few days after the centres were struck, it settled 1¼ inch, which increased slowly to 2¼ inches, after which no further subsidence was observed. The arch had thus arrived at the exact dimensions which were proposed by Mr. Rennie.

An account is then given of the progress of the remainder of the structure, the forming of the parapet, the roadway, the approaches, &c., the whole of which were finished on the 18th of June, 1819, having occupied thirty-three months in construction.

The stone used in the bridge, is a brown coarse sandstone, or mill-stone grit, of great durability, from the quarries at Bramley-fall, about four miles from the bridge; they were brought down by water to within 120 yards of the work. The price of the stone in the vessel alongside the work, scappled ready for dressing, was 9*d.* per cubic foot; the dressing and setting, exclusive of the cornice and the parapet, cost 4½*d.* per cubic foot, which, with conveyance and mortar, made in the whole 15*d.* per cubic foot; the cost of the cornice and parapet walls was about 4*d.* per cubic foot extra.

The total quantity of masonry was 80,000 cubic feet, and the entire cost of the bridge, including the toll-house, was 7,530*l.*

The paper is illustrated by three drawings showing the plan, elevation, and longitudinal and transverse sections of the bridge, with the details of the masonry and the centring.

Mr. George Rennie concurred in the accuracy of the description of the "Wellington" Bridge; it presented an excellent example of theory and practice, not only on account of its strict conformity with the principles of equilibrium, but from the correctness with which the works had been executed, as was evinced by the small subsidence of the arch after the centres were struck.

Respecting the theory of the arch, writers were nearly agreed upon the principles established by De la Hire, upon the equilibrium of a loaded chain, or of a series of voussoirs, or wedges, with polished touching surfaces, as shown in his "Traité de Mécanique," in 1695.* The subject had been variously demonstrated by writers, but with little effect; architects were forced to select examples at random, for which no precise rules existed; but any person, on examining the actual state of an equilibrated arch of solid materials, or of a substantial chain suspended at its extremities by points, would immediately perceive the difference in the curves, or loads on the extrados, arising from the want of sensibility in the arch, or in other words, from friction and adhesion. Hitherto theory had been unable to comprehend these retarding forces which had actually been so serviceable to the architect: Perronnet was perhaps the first to throw any real light upon the subject; the experiments which he undertook, on the absolute strength of materials, in the year 1758, previously to the commencement of the celebrated bridge of Neuilly,† and subsequently, those by Gauthey, on the failure of the piers of the church of St. Geneviève,‡ at Paris, were very instrumental in the advancement of the art. It was, however, chiefly owing to the good quality of the material, that Perronnet was enabled to surmount the difficulties which

* "Traité de Mécanique.' De la Hire. 12mo. Paris, 1695.

† "Description des Projets et de la Construction des Ponts de Neuilli, de Nantes, d'Orleans, &c." Perronnet. 4to. Paris, 1788.

‡ "Construction des Ponts.' Gauthey. 4to. Paris, 1809.

arose from the unusual subsidence of the arches, in the bridge of Neuilly. The splaying of the arches, by which a double curvature was given to them, and which had been injudiciously copied in this country, was neither justified by science nor practice. The results of the French experiments were much too slow in reaching this country, and the strength of building materials was but little attended to, until within a recent period.

In the year 1824, the late Dr. Thomas Young having engaged to contribute the article "Bridge," to the Supplement of the sixth edition of the "Encyclopædia Britannica," applied to Mr. Rennie, to furnish the particulars of the Waterloo and Southwark bridges, then just completed; when, finding the data insufficient, Mr. Rennie undertook a series of experiments on the absolute and relative strength of materials, part of which he communicated to Dr. Young, and he subsequently published the whole in the "Philosophical Transactions" for 1818.* The results were then applied to the calculations, on the lateral thrust of the arches of those bridges, perhaps for the first time in this country, and which were more amply applied afterwards to bridges in general by Mr. Ware, and his tables of the relative boldness of brick, stone, and iron bridges, were valuable accessions to our knowledge on this subject.†

As regarded the friction of arches, Mr. Rennie found that the arch stones of Waterloo and New London bridges commenced gliding, or pressing upon the centres, at angles of from 33° to 34°; he believed that soon after the adhesion of the mortar commenced, the centres would have very little pressure on them, even from stones at an angle of 45°.

As to the gliding of the arch stones at the haunches, from the pressure of the upper voussoirs, he had never seen an instance of it; but he had seen the haunches so much eased from the centres, by the lateral action, exerted in driving the stones into the vertex of the arch, as to allow the lagging, or cross bearers above the ribs, to be taken out. This proved the correctness of the rotative system of voussoirs, as shown by experiment.

With respect to adhesion, Mr. Rennie had seen its effect on broken arches of considerable magnitude, among the buildings of Rome, and also in the bridge of Alcantara, over the Tagus, where the centre arch, of nearly 100 feet span, had been blown up by the French, leaving the adjoining arches and piers, which were upwards of 90 feet in height, standing perfectly undisturbed.

With respect to the magnitude of arches, M. Perronnet expressed himself confident that arches of 500 feet span could be safely executed. The bridge which he proposed to construct, over a branch of the Seine, at Melun, consisted of a segment of a circle of 400 feet. The experience he had derived from the length of the primitive radii of the arches of the bridge of Neuilly, and his experiments on the strength of materials, would appear to justify so bold an experiment.

Mr. Rennie was of opinion, that with our strong magnesian limestones and hard granites, arches of larger span than any hitherto built, might be safely constructed.

There were numerous examples, both in ancient and modern times, of very large arches. The bridge of Narni, in Italy, of Vielle Brioude, in France,* and of Alcantara, in Spain, by the ancients; and those of Gignac and of Castel Vecchio, by the middle ages; but the most remarkable example of cylindrical vaulting (the remains of which still existed), was the bridge of Trezzo, over the Adda, in the Milanese.† The span was 251 feet over the chord, and 266 feet over the semicircle. The stone beams in the church of the Jesuits at Nismes, and those between the towers of Lincoln Cathedral, the former equal to the segment of an arch of 565 feet span, and the latter to one of 262 feet span, proved how much could be done with materials of small dimensions.‡

In modern times there were examples of bold vaulting in France, in the bridges of

* Vide "Phil. Trans.," 1818, p. 118.

† Vide "A treatise on Arches and their abutment piers." By Samuel Ware. 8vo. London, 1809.

* The following dimensions of Pont de Brioude are given in a letter from M. Seguin to M. Rennie (dated Feb. 27, 1827.) "The ancient bridge was constructed by the Romans for the use of foot-passengers, pack mules, and small carts drawn by oxen.

		Metres.		English feet.
Length of the arch	...	56	=	183·73
Breadth ,,	...	5	=	16·005
Height ,,	...	18 to 19	=	59·058 to 61·339

"The arch was a segment of a circle, formed of volcanic stone, of little consistence. The bridge gave way in the course of time, but was upheld for fifteen years, by means of buttress walls, 6 metres (=21·68 English feet) in thickness, and 10 metres (=32·8 English feet) in height; and also by bars of iron, fixed in the wing wall, and through several courses of the arch-stones. The structure finally fell, and a new stone bridge has been erected upon the same site, of which the following are the dimensions:"—

	English feet.
Opening of the arch, (which is a semicircle)	150·9
Breadth of ditto	24·7
Height from the stream to the pavement...	83·7

† A section of this arch is shown in Part 1 of the "Theory, Practice, and Architecture of Bridges." Hann and Hosking. 8vo. Weale. London, 1839.

‡ Robinson, in his "Travels in Palestine," mentions the remains of an arch over the valley of Kedron, at Jerusalem, supposed to have been 350 feet span.

Neuilly, Mantes, St. Maixence, and Jena; in Italy, in the Ponte Sta. Trinita, Turin; in England and Wales, in the bridges of Llanrwst, of Pont-y-tu-Prydd, of Gloucester, of Chester, and those of London and Waterloo over the Thames; independently of numerous arches and viaducts, more recently erected for the use of railways.

The radii of curvature of the centre arch of New London bridge, taken near the vertex, would equal in boldness an arch of 333 feet; and the length of the key-stone, at 4 feet 9 inches, would make the depth only $\frac{1}{70}$th of the whole span.

The origin of the arch had occasioned much controversy. The subject had been learnedly investigated by Dutens, Le Roy, King, and others, but apparently to little purpose, as the invention of the arch would now appear to be, with more justice, attributed to the Egyptians, as they seemed to have used it many centuries before the Christian era.

The researches of modern travellers, particularly those of Sir Gardiner Wilkinson,* proved that the brick arch was known in Egypt in the reign of Amenoiph I., 1540 years B.C., and the stone arch in the time of Psamaticus II., 600 years B.C. "The most remarkable," says Sir Gardiner Wilkinson, "are the door-ways surrounding the tanks of Assassief, which are composed of two or more concentric semicircles of brick, as well constructed as at the present day, and all the bricks radiate to a common centre."

Mr. Hoskins was of opinion that arches were constructed long anterior to the time of the Ptolemys; for in the pyramids of Ghebel Birkel and Dunkalie, which were of more ancient date, both round and pointed stone arches were discovered.

Mr. Perring stated that he found at Thebes some remarkably well-formed arches of 12 feet to 14 feet span, built in concentric half-brick rings, the bricks of which were marked with the name of Sesostris; consequently they were upwards of 3180 years old.†

A representation of the tomb of Saqqara and its arched vault of stone was given in the vignette of the 10th chapter of the 3rd volume of Sir Gardiner Wilkinson's "Manners and Customs of the Ancient Egyptians."

The arch seemed to have been known to the Etruscans; and from the representations of their palaces and their sea-ports, the arch appeared generally to have been employed for moles and jetties.

* "Manners and Customs of the Ancient Egyptians." Wilkinson. 3 vols. 8vo. London, 1837.

† Vide Minutes of Proceedings, Inst. C.E., for 1843, page 170.

With reference to the knowledge of the arch among the Greeks, opinions were very contradictory. The researches of modern travellers had brought to light many curious remains of Cyclopean or Pelasgic architecture; but in confirming the descriptions of the ancient cities of Mycenæ and Orchomenos, they had left us still in ignorance as to their actual knowledge of the arch.

Mr. Rennie exhibited a series of lithographic prints, from drawings made by the late Mr. Dodwell during his travels in Greece. They displayed the various doorways of Pelasgic fortifications, from the lintel of single stones resting on upright jambs, to the overlapping of the stones until they reached each other, in the form of a triangle, as in the gate of the lions, the entrance into the treasury of Atreus, &c.

But the most remarkable monument was the subterranean chamber, of which Mr. Dodwell's lithographic plate gave an imperfect idea; complete plans and sections of that extraordinary building were given by Mr. Donaldson in the supplement to the "Antiquities of Athens,"* from which it appeared to have been constructed in the form of a parabolic cone, of 48 feet in diameter at the base, and 44 feet 6 inches in height, by means of rings of regular masonry, overlapping each other until they reached the apex, where the aperture was closed by a flat stone. From this and other buildings of a similar kind, there was reason to infer that the ancient Greeks had very imperfect notions of the arch.

Mr. Kinnard, in his "Description of the Antiquities of Delos,"† gave a representation of a portal or gateway on the ascent of Mount Cynthus, formed to support the wall of the ancient fortifications. The entrance was constructed with ten large stones inclined to each other, like those at the aperture into the great Egyptian pyramid. It was, perhaps, the earliest specimen of Pelasgic architecture in Greece, displaying the first step towards the principle of the arch.

That it was known by the Etruscans seemed evident from the remains of arches and bridges now existing in the country of the Volsci in Italy; and the researches of travellers in that country, within the last few years, had brought to light many curious examples, anterior to the period of the Cloacæ of Rome, and the tunnel of Albano by Ancus Martius.

Mr. Rennie was of opinion, from his examination of the subject, that there existed no sufficient evidence, to establish the know-

* "Antiquities of Athens," &c. Stewart and Revett. Supplement. Folio. London, 1830.

† Ibid.

ledge, or use of the arch among the Greeks.

Mr. Page presented two sketches (No. 3621), made by him of two arches at Cape Crio (Cnidus, Rhodes.) These arches were semicircular, built of large stones regularly radiating from a centre, without any mortar in the joints, and stood among Cyclopæan remains, of which they apparently formed a part. He was of opinion, that the Greeks were aware of the properties of the arch. They evidently appreciated its form, for it must have been noticed by all travellers, how frequently the flat lintels were cut out on the under side; several specimens of this existed in the sepulchral remains now in the British Museum. At Athens he had noticed a very considerable excavation of a regular arched form through solid marble.

Mr. Rennie observed, that as more useful lessons were given by failures in construction than by records of successful undertakings, he had caused a large drawing to be made of the bridge of the Boverie at Liège, showing its state at the time of the report upon it, by the commissioners appointed by the Belgian Government, when it was condemned, and was ordered to be reconstructed, at the cost of the contractor, which however had not yet been done.

The bridge, which was built of hard, compact, magnesian limestone, consisted of five arches of 78 feet span each, with a versed sine of 8 feet, which was between $\frac{1}{8}$th and $\frac{1}{10}$th of the span. The form of the arch was that of a segment of a circle of 100 feet radius, the angle of the springing was therefore 46° 45′. The abutments at either extremity were of rubble masonry, and were very deficient in weight and dimensions.

The obvious consequence of this want of due proportion was, that the abutments gave way, all the arches sunk at their centres, many of the stones nearly falling out, several of them were fractured in both directions, serious dislocations occurred in each pier, above the springings of the arches, and also down upon the cutwaters, and in spite of all attempts to remedy the defects, the bridge was condemned, and was taken down, although it had cost upwards of £25,000.

It was evident that these flat arches were not well proportioned, and that the abutments were insufficient to support their thrust. It appeared also, from the report of the Commission, that sufficient attention had not been paid to the quality of the workmanship, or in the selection of the materials employed.

MIDDLETON'S CHIMNEY-POT AND COWL SWEEPER.

[Registered under the Act for the Protection of Articles of Utility.]

Fig. 1.

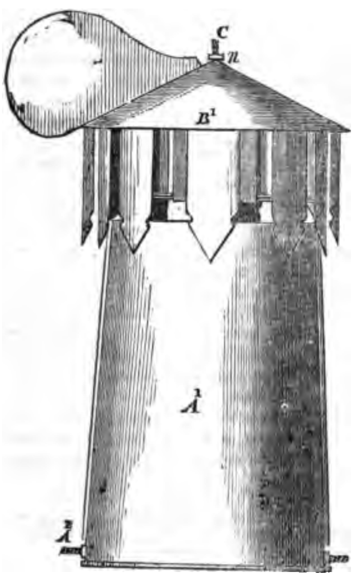
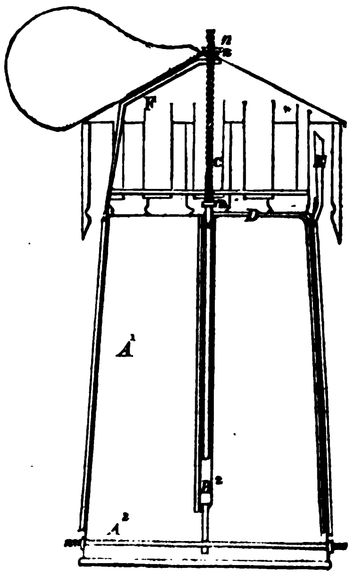


Fig. 2.



Chimney-pots, from being usually much narrower than the chimneys which they surmount, become much sooner foul; and are not seldom, we believe, the unsuspected cause of that reflux of smoke into our apartments, which we are so invariably in the habit of laying to the score of the chimney alone. We should not, probably, go far wide of the mark, were we to assert, that where a chimney needs sweeping once, the chimney-pot needs sweeping twice; or conversely, that were the chimney-pot as often swept as it ought to be, the chimney need not be swept half as often. But to sweep the chimney-pot only, is what no one ever thinks of,—it is always both or none. A palpable mistake this, which probably requires only to have public attention drawn to it, to be speedily rectified. We are the more inclined to hope so, that we are able at once to tell our good friends, the public, how the thing is to be done. Order, forthwith, "Middleton's Chimney-pot and Cowl Sweeper"—a very clever, most efficient, and even elegant apparatus. It is so contrived as to serve at once the purpose of a windguard and of a soot-sweeper; there is a cowl to keep off the wind, which cowl transmits the rotary motion given to it by the wind to two sets of scrapers, which keep both the chimney-pot and cowl constantly clean. If not literally self-acting, it requires at least no one to work it—neither climbing-boy nor machine man; it needs fixing up only, and does its duty admirably without any looking after, or any hope of fee or reward.

Fig. 1 of the prefixed engravings represents an external elevation of the apparatus, and fig. 2 a sectional view. A^1 is the pot, and B^1 the cowl or cap. A^2 is a horizontal bar, which is passed through the pot near to the bottom, and supports a vertical tubular shaft, B^2, which rises to the top of the chimney-pot; C is the vertical axis of the cowl B^1; the lower end being passed down, and revolving within the tubular shaft B^2, and the upper end being screwed to receive nuts *n n n*, by which the cowl is secured to it at top, and kept free from contact with the chimney-pot at the bottom. D is a sweeper, which is made fast to the revolving axis C, and consists of a horizontal rod of about half the diameter of the chimney-pot, with two pendant but rigid arms, one of which hangs close to, but without touching the inside of the pot, while the other is in the like proximity to the central tubular shaft B^2; when the wind causes the cowl B^1 to revolve, it comes round with it the sweeper D, the arms of which sweep away whatever soot may be adhering in the inside of the chimney-pot, or to the exterior of the tubular shaft. But as soot may also collect within the cowl itself, there are two fixed scrapers, E and F, which project upwards from the chimney-pot within the cowl, and cause it to be swept simultaneously with the pot. The scraper F is attached at top by a ring to the axis C, for the purpose of better preventing the cowl from being blown off by any gust of wind.

ROTARY ENGINES—JONES'S—BORRIE'S.

Sir,—I observe in your Magazine of last week, that Mr. H. Crosley has brought forward a rotary engine, the proprietorship of which he has an interest in, and which was patented more than two years ago by Mr. Jones. He claims for it a relationship to my revolving engine, which I patented a month or two ago; but a more unwarrantable claim could not possibly be made, as there is no similarity in construction or arrangement whatever between them.

As to the *principle* which he brings so prominently before your readers being the same, I beg to inform Mr. C. that it neither belongs to Mr. Jones nor myself, as Mr. Watt patented several engines on the same *principle* about sixty years ago, and numerous others have been patented since that time on the same *principle*, many of which, I have no hesitation in saying, were far superior to the one Mr. C. has now produced.

It appears that both the engines have been patented through your office, and from the information you possess regarding all kinds of patents, I have no doubt that your sound judgment in these matters led you to the conclusion at the time you were carrying forward my patent, that my engine was very different from that of Mr. Jones, otherwise you would have informed me of the existence of such a prodigy.

I agree with Mr. C., that the *public press* is the most powerful of all presses, and hope that on the present occasion it will show its superiority to the hydraulic, which he remarks is "said to be unlimited," but Mr. C. knows, from what he has had to do with them, that it requires some *practice* to make them so.

You were pleased to insert as many figures of a drawing I sent you of my revolving engine as you had room for in your Magazine of 20th April, and also a full description and analysis of its power and economy, which I have no doubt will satisfy every candid reader of its superiority. Now I think that Mr. C. ought to make a drawing and description which the public will be able to understand thoroughly before he talks about similarity between my engine and that of Mr. Jones; he should also show by analysis wherein the superiority of Mr. Jones's engine consists.

A single glance at the two drawings will convince any one of the absurdity of Mr. C.'s claims. It will be observed that the outer chamber of Mr. J.'s engine is elliptically shaped, while that of mine is a true cylinder. The great difficulty of constructing the former, makes the latter far preferable. Again, Mr. Jones's engine has a revolving cylinder or piston, (as he calls it,) which is placed *exactly in the centre of the outer chamber*, and touches its circumference at *two* points; in my engine there is a revolving cylinder *placed eccentric to the outer one* and touching its circumference in *one* point only. Mr. Jones has *three* slides working through the revolving cylinder or piston, which when the pressure of the steam is on their projecting parts, will not have sufficient length inside the cylinder to counteract the leverage exercised by their projecting parts, so that they would consequently lock or jam themselves in the passages through which they slide: indeed it is very questionable whether they will slide at all. I have in my engine *two* sliding pistons, upon the *four* ends of which the steam acts, and which have all the diameter of the revolving cylinder to counteract the bad effect which the leverage of their projecting parts would otherwise have upon them, so that there will be no locking or jamming, and they will consequently slide freely. Mr. Jones shows no packing for keeping his slides steam-tight, or for making up for wear and tear, all of which is amply provided for in my engine. The slides of Mr. Jones's engine, Mr. Crosley says, are pressed out upon the circumference of the outer chamber by "*circular or hexagon rings*; but how a circular as well as a hexagon ring can perform the same duty in pressing three slides towards the circumference of an elliptically shaped chamber, it is very difficult to conceive. The two sliding pistons of my engine have no circular or *hexagon* rings to push them out, their sliding motion being caused by their extremities impinging upon the circumference of the outer cylinder, and the eccentric position of the revolving cylinder.

It is generally expected that a properly constructed revolving engine can be worked at a high velocity. Now I cannot see how the slides of Mr. Jones's engine can work between circular or hexagon rings, and the interior of an elliptical chamber, at any ordinary velocity, without breakage. Indeed it is questionable, from all the information presented to your readers, whether the slides can be kept steam-tight, or that the piston can even make a single revolution. And although it were capable of turning round, it is evident that it cannot be worked economically—not being constructed to work on the expansive principle which is well known to be a most decided improvement in steam-engines. In my engine the principle of expansion can be carried out to any extent, and that too by the aid of the sliding pistons alone, as formerly described in your Magazine. The arrangement of the cylinder ports and the form of the reversing slide are *entirely* different in the two engines. Mr. Jones's engine is only a high-pressure one; mine is either a condensing or non-condensing engine, having a double-acting air-pump, a condenser, and all the other details necessary to constitute a complete engine. Indeed I have no doubt that the most of the deficiencies common to engines on the rotary *principle* have been rectified in it.

Mr. Crosley says, that the reason why this extraordinary engine, "*which he can supply as well as the Cambrian*," has never been brought before the public, is, that it is his opinion, and also that of Mr. Jones, that the rotary is inferior to the reciprocating or vibrating engine. As regards Jones's rotary one, this may well be, but of course it does not follow, from that circumstance, that every other rotary engine is to be inferior.

If Mr. Crosley thinks so little of the rotary principle that he has kept back so long from the public view this prodigy, which he "has the vanity to believe is the best hitherto produced," he must surely see something superlatively good in mine, or else he would not be so anxious to claim relationship with it.

I remain, Mr. Editor,
Yours respectfully,
PETER BORRIE.

8, Prince's Square, St. George's East,
June 5th, 1844.

ABSTRACTS OF SPECIFICATIONS OF ENGLISH PATENTS RECENTLY ENROLLED.

MOSES POOLE, OF SERLE-STREET, GENTLEMAN, *for improvements in en-*

veloping medicines. (Communicated by a foreigner residing abroad.) Patent dated October 12, 1843. Specification enrolled April 12, 1844.

Sometimes pills have been coated with gelatine, in order that they may taste pleasant, or, rather, have no taste at all; but, according to Mr. Poole's foreign informant, this "gelatine covering dissolves too quickly," and causes often "nauseous eructations." He proposes, therefore, to envelope them in single or double folds of animal membrane; which, "resisting the humidity and heat of the stomach, and in some degree the digestive powers of the gastric juice" will not give way until the pills arrive at the intestines. Like the sealed fighting orders, with which naval officers are sometimes entrusted, not to be opened till in a certain latitude and longitude, the Poole Pills are not to operate till they reach their destined scene of action. "I do not confine myself," he says, "to precise details, *so long as* the peculiar character of the invention *be* retained. What I claim is, the mode of enveloping medicines, by applying an organic substance or membrane, as above described."

Julius Adolph Detmold, of London, Merchant, *for certain improvements in the construction and arrangement of furnaces or fire-places, applicable to various useful purposes*. Patent dated Oct. 18, 1843. Specification enrolled April 18, 1844.

The principal benefits anticipated from these improvements are:—1. A more intense temperature than is produced in reverberatory furnaces of the ordinary construction. 2. An important saving of fuel. 3. A better yield in the working of metals—or, in other words, a diminished loss of metal, from oxidation.

1. Mr. Detmold proposes to make the fire-grate of his furnace much deeper than those in furnaces now in general use, so as to have always a very thick stratum of fuel upon the grate, thereby preventing the passage of any undecomposed air through the grate into the furnace. In ordinary furnaces, the depth of the grate—that is, the distance between the grate-bars and the top of the fire-bridge—is generally from twelve to eighteen inches, and rarely as much as two feet; but in Mr. Detmold's furnaces, the depth of the grate is from three to five feet, according as the coal used is more or less bituminous. When a caking or highly bituminous coal is to be employed, he makes the grate not less than three feet in depth; for the use of free burning coal, four feet; and for stone-coal or anthracite, he finds a depth of five feet most advantageous.

2. Instead of relying upon the draught of a high chimney for the combustion of the fuel, he forces the requisite supply of air, by means of any ordinary blowing machine, under the grate into the ash-pit, which is closed by an air-tight door. The blast, he says, will cause the imperfect combustion of the "lower stratum of coal immediately upon the grate, and the greater portion of the gases resulting from this will be a combustible gas—namely, the *carbonic oxide gas*, which is invariably produced when the proportion of carbon is in excess to that of oxygen; the portion of *carbonic acid gas* which is produced will, in its passage upwards, through the superincumbent mass of ignited coal, absorb an additional dose of carbon, and will thereby also become converted into *carbonic oxide gas*; at the same time, the carbonaceous gases contained in the fuel, such as carburetted and bi-carburetted hydrogen, will be evolved or distilled from the coal by the heat; and thus all the fuel in the fire-chamber is converted into combustible gases, which will pass over the fire-bridge into the furnace."

3. The combustion of these gases is effected by forcing amidst them, in their passage over the fire-bridge, heated and compressed atmospheric air, supplied in numerous small streams, "thereby causing a rapid and intimate combination of the oxygen of the air with the combustible gases, and, consequently, their immediate and perfect combustion, and a most intense temperature in that part of the furnace where it is required."

The body of fuel in the fire-chamber, with the exception of the stratum resting immediately upon the grate, is never at a high temperature, as is the case in ordinary furnaces, but is kept at a low red heat, which is supposed to be quite sufficient to effect the transformation of all the fuel into combustible gases. The supply of blast (cold) under the grate, by which the combustible gases are generated from the fuel, and the supply of hot air for their subsequent combustion, is regulated by means of cocks or valves, which are directed to be so adjusted to each other as to effect the complete combustion of the gases, without having an excess of air in the furnace." "Thus, the effects of the flame in the furnace may be made at will, either reducing, neutralizing, or oxidising, according to the quantity of combustible gases generated, or the volume of hot air admitted for their combustion. The heat thus produced is more directly applied to the purposes required than in ordinary furnaces, in which the heat is produced by the imperfect combustion of

the solid fuel in the grate, and where the metal under operation derives its temperature merely from the flame, in its passage through the main or working chamber of the furnace; whereas, in my improved furnace, the temperature in the fire-chamber, where the combustible gases are generated, is quite low—but their actual combustion, and the intense temperature resulting therefrom, is concentrated in the very spot where the metals are placed for operation, and where the greatest heat is required. The loss of fuel, by the escape of unconsumed combustible gases out of the chimney, is thus avoided; and, as the combustion of the gases in the furnace is effected under a pressure greater than that of the atmosphere without, the loss of metal, by oxidation, in consequence of the air entering into the furnace, through the working door, or through any openings or crevices in the furnace, is entirely prevented." Mr. Detmold states that "any kind of coal may be advantageously used in furnaces of this description; but that they will be found particularly applicable to the use of stone coal, or anthracite, which has hitherto not been successfully employed for metallurgic purposes in reverberatory furnaces. He adds, that furnaces of this improved construction may be employed with great advantage in the working of all kinds of metals, and that he has himself used them with complete success for "refining, puddling, and re-heating bar-iron, as also for the forging of heavy pieces, such as steamboat shafts."

A furnace constructed on these principles, for refining iron is represented in the following figures*—

Fig. 1.

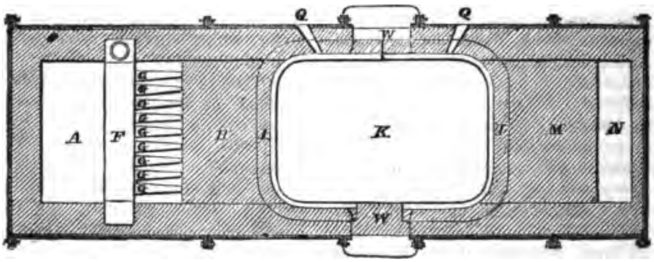
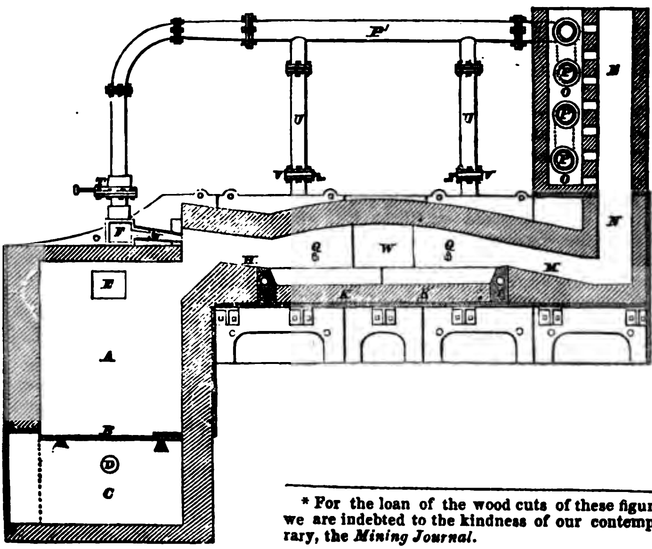


Fig. 2.



* For the loan of the wood cuts of these figures we are indebted to the kindness of our contemporary, the *Mining Journal*.

Fig. 3.

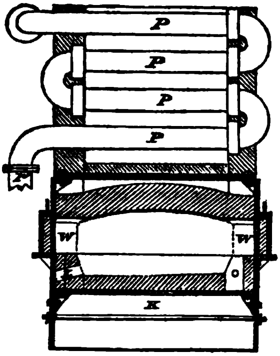


Fig. 1 is a horizontal section, showing the plan of furnace; fig. 2, a vertical longitudinal section; and fig. 3, a transverse vertical section, showing the air-heating pipes in the stack.

A is the fire-chamber, in which the fuel is converted into combustible gases.

B is the grate, upon which the fuel is supported.

C is the ash-pit, which is closed in front by an iron door.

D is an opening in one of the sides of the ash-pit, through which atmospheric air is blown into it.

E is the stoking hole, for filling the fire-chamber with fuel.

F is the hot-air chamber, which is placed on top of the fire, or gas-generating chamber, and from which issue a row of blow-pipes, G, through which the hot air is blown amidst the combustible gases in their passage over the fire-bridge. The hot-air chamber, F, is of cast-iron, and the blow-pipes are of sheet-iron; they are made about fifteen inches long, two inches diameter at the larger end, and one inch and a quarter at the mouth, which should be slightly flattened. In this instance, there are nine blow-pipes used; but a greater or less number may be employed.

H is the fire-bridge, over which the combustible gases and the streams of hot air become mingled; it is made much longer than in ordinary furnaces, being 2 ft. 6 in. from the end of the blow-pipes, for the purpose of affording the gas and air time to become thoroughly combined before entering the main chamber of the furnace.

I I are cast-iron blocks that surround the entire hearth of the furnace, and through which a stream of cold water is made to circulate, for the purpose of protecting the sides from the intense heat, and the destructive effects of the melted iron and scoria.

K K is the hearth, which may be made of fire-bricks set very close on edge, or of good fire-sand. It is made to slope towards the tap-hole, L, so as to enable the refined iron to run out more easily.

M is the throat, or flue, of the furnace.

N is the stack or chimney.

O is a chamber, in which is placed a system of pipes for heating the air. This chamber is separated from the stack by a partition of brickwork, which has, however, numerous openings, through which sufficient heat is communicated to the pipes, P P P P, to heat the air which is forced through them to the required temperature. This may be regulated with great nicety, by allowing more or less of the burnt gases to pass into the chamber O, through the openings in the partition, by contracting either the chimney, N, or the chamber O, at the top.

Q Q are tuyeres, through which streams of hot air are blown upon the melted iron, for the purpose of refining and decarbonising it. They are so placed that their axes converge towards the middle of the hearth, and have a pitch of from 25° to 30°, which will cause the liquid iron to move round in two opposite currents, thereby exposing every part of the surface of the metal to the decarbonising action of the hot blast.

R is a pipe leading from the blowing machine that supplies the cold blast, and from which a branch *r*, goes off, to furnish the blast under the grate into the ash-pit, and which is regulated by the valve, S. Another branch, *r′* rises, and communicates with the pipes, P, in the chamber O, whence the heated air is conveyed by the pipe, P′, to the hot-air chamber, F, where its supply is regulated by the valve, T.

U U are two small branch pipes, descending from the pipe P′, which convey the hot blast to the tuyeres, Q Q, which is regulated by the valves, V V.

W W are the working doors of the furnace, there being one on each side of the furnace.

The mode of refining iron in a furnace of this kind is as follows:—The fire-chamber, A, is filled with fuel, and after it is ignited the cold blast is let on under the grate, by which the combustible gases are generated; the valve, T, is then gradually opened, to admit the hot air for the combustion of the gases. After the furnace has been brought to a white heat, from 25 cwt. to 30 cwt. of pig-iron is charged, and spread all over the hearth, piling it in such manner that the flame may circulate well through. When the charge is melted down quite thin, which will generally be the case in one hour and three-quarters, the hot blast is let on through the tuyeres, Q Q, by which the iron will

become refined. In about one hour to one hour and a quarter, the metal will be found sufficiently refined, when the furnace is tapped, and the metal runs into the mould.

This mode of refining is stated to afford a very important saving of iron over the ordinary method, in the open finery fire. "In the latter, the iron is exposed to the oxidising action of the blast from the tuyeres, during the whole period of its melting down, so that a very large proportion of the iron is actually converted into cinder before the whole charge is fused. The loss of iron in the open finery varies from 12 and 15 per cent.; but in the operation of refining, in my improved furnace the whole charge of iron is melted down without any loss from oxidation, as no more air is allowed to enter the furnace than what is required for the combustion of the gases—and the process of decarbonisation does not commence until after all the iron is fused; the loss of iron in my furnace is, therefore, much reduced, and rarely exceeds 7 per cent., but varying, generally, from 5 to 7 per cent."

Furnaces of this description may, it is said, be also employed with great advantage for the puddling of crude or pig-iron, by combining the two processes of refining and puddling in the same furnace. "When employed for this purpose, the hearth should be made about eighteen inches wider than that of the refinery furnace just described, which it resembles in all respects except the bottom, which is the same as in ordinary puddling furnaces. The charge is double, being about 9 cwt.; and, as the furnace has two working doors, opposite to each other, two puddlers work at it at the same time. After the charge is melted down, it is subjected to the streams of hot air from the tuyeres, in the same way as in the refining process; but, instead of tapping the metal when it is sufficiently refined, the blast from the tuyeres is shut off, and the quantity of gas to be generated is slightly diminished, whereby the temperature of the furnace is reduced to a proper puddling heat. The puddlers then commence to work the iron, the same as in the ordinary furnace, regulating the temperature at will, by generating more or less gas as may be required.—The re-heating and mill furnaces, or such as are intended for the forging of heavy pieces, are the same in their arrangement of parts as the refining or puddling furnaces just described, varying only in the shape and dimensions of the hearth, according to the nature of the work for which they are intended."

Charles Tetley, of Bradford, York, Gentleman, *for a certain improvement or improvements in the construction of boilers and other generators for providing steam.* Patent dated June 30, 1843. Specification enrolled Dec. 30, 1843.

Mr. Tetley describes his invention as consisting of a division of the boiler into two or more compartments, of different heating temperatures, having channels for feeding the compartments with water, from that or those containing water of a lower temperature. The first partition is placed vertically over the water space, at the back of the boiler—the top of which reaches somewhat above the water-line, and the bottom below the level of the fire-bars, but leaving a passage for the water beneath it. The second partition reaches from the bottom of the tubular part of the boiler, to a little above the level of the fire-box, and is removed but a short distance from the first partition. The third partition is placed in the middle of the tubular boiler; and, like the first, runs up above the water level. A communication is formed for the supply of water, by a pipe running from the compartment nearest the chimney-box, into the middle compartment; the top of the pipe being just under the top water level, and the bottom of the pipe entering the middle compartment, at or near the bottom of the boiler. On evaporation taking place, the steam diffuses itself over the top of the partitions, thus maintaining the same pressure on the surface of all the water. Evaporation commences in the compartment over the fire-box; and the water, converted into steam, is reinstated by the surface water from the second or middle compartment, which is delivered almost or entirely at the evaporating point. In like manner the middle compartment is kept continually fed from the top layer of water in the third compartment, which is supplied by a pump, in the usual way. By this arrangement, Mr. Tetley states, a saving of fuel equal to about 21 per cent. is obtained, the prevention of a deposit of sediment is effected, the steam is got up more rapidly, and the action of a float, for regulating a feed-apparatus is rendered much more certain.

Arthur Dunn, of Rotherhithe, Soap-Boiler, *for improvements in the manufacture of soap.* Patent dated November 9, 1843. Specification enrolled May 9, 1844.

By Messrs. Gwynne and Wilson's patent method of manufacturing soap, described in our last number (p. 367) steam is diffused in numerous small streams, through the constituent materials; by Mr. Dunn's method, of which we have now to give an account, streams of hot air are so diffused instead of steam.

In the well of the soap-copper, just below the flange or joint, is placed a circular ring of pipe, perforated with small holes, the pipe being kept sufficiently off the bottom to allow a stirrer to be used to scrape the bottom of the copper when necessary. This ring of pipe is supplied with atmospheric air from a cylinder-blast, or other forcing apparatus, and connected with such forcing apparatus by means of a pipe, rising up to the top of the copper, where it is furnished with proper means of connexion and disconnexion. A sufficient quantity of lye and fatty matters being put in the copper, and the fire lighted—when the lye, &c. is hot, the blast is set in action; and when the strength is taken up from the lyes, more lyes are added, until the grease is "killed," as it is termed; resin is then added, with more lye. The blast is kept in action the whole time, if the fires draw well, and if they do not, the blast is stopped for a short time, before adding the resin, to allow the contents of the copper to reach nearly the boiling point. When the resin is melted and mixed with the soapy mass, and the whole strength of the lyes taken up, the blast is stopped, and the contents of the copper briskly boiled up. The spent lyes are then allowed to settle, after which they are pumped off, and the soap finished off in the ordinary manner.

Edmund Snell, of Bridge-road, Lambeth, Medical Student, *for improvements in the manufacture of soap.* Patent dated Nov. 21, 1843; Specification enrolled May 21, 1844.

These improvements consist,—*firstly*, in combining with the usual saponified fats or oils certain vegetable extracts, obtained from potatoes, which he calls *dextrine* and *fibrine*; and, *secondly*, in a peculiar mode of obtaining the dextrine and fibrine.

The dextrine is employed for the finer soaps only. It is made into a thin paste by the addition of hot water, and then added to the saponified matter in the boiler (after all the spent lye has been pumped out,) in the proportion from 4½ to 5 cwt. of dextrine to each ton of saponified matter.

When the *fibrine* is used for the manufacture of common soap, it is put in a pasty state into the boiler along with an equal quantity of oil or resin; alkali is then added in the usual way, and the whole is boiled until it is ready to be cleansed into frames.

The dextrine and fibrine are prepared by passing potato pulp through a series of vibrating sieves subjected to the action of streams of water, by which the coarse portions of the pulp are separated from the fine. The finest is the dextrine; the coarser the fibrine.

Nicholas Troughton, of Swansea, Gentleman, *for improvements in dressing ores requiring washing.* Patent dated June 23, 1843; Specification enrolled Dec. 28, 1843.

Mr. Troughton makes use of a series of eight sieves, of peculiar construction, in one frame—or, as it may be considered, one long sieve, divided into eight compartments. They are formed with a double inclined plane, and inclosed on all sides with plates, so as to form a perfect box. At one end are two flap valves, opening upwards—so that when the whole frame is plunged into water, the fluid rushes through the valves, and flows over the whole range of sieves. Two connecting rods attach this apparatus to an eccentric, on an axle, to which is affixed a fly-wheel, and at the other end is set in motion by a band, communicating with a drum, which is turned by a common winch handle. The ore, after being properly broken, is placed in a hopper over the end of the range of sieves nearest the flap valves, and by turning the machinery, a rapid up and down motion is given to the sieves, which are placed on the surface of a large cistern of water, and every time they dip into the water, it rushes through the valves, and passing over the whole range of compartments, carries all the lighter particles of matter which fall from the hopper from one sieve to the other, depositing the heaviest as it passes over each, and the refuse is at length washed over the end. When the sieves are full the washed ore is to be shovelled out.

THE CITY OF CANTERBURY STEAMER.

Sir,—During the winter months the City of Canterbury has had her engines thoroughly repaired, and new tubular boilers placed on board of her, by Messrs. Penn and Son, of Greenwich.

Yesterday she made her first experimental trip down the river; and, by repeated trials, at the measured mile, in Long Reach, her average speed was 13¾ miles, being considerably more than her very best originally.

The great lightness of the tubular boilers has caused the vessel to draw 6 inches less water; and although the engines have been placed farther aft, the saloon has gained six feet in length.

In the course of the day she fell in with the Royal William, and in a short run beat her very considerably. I am, Sir, yours, respectfully, John Matthew.

Greenwich, June 4, 1844.

NOTES AND NOTICES.

Sub-Marine Battery.—(From the *Whig Standard*, Baltimore paper.)—On Saturday last, great crowds were attracted to witness the destruction of a full rigged barque, under full sail, by means of a Submarine Battery. At half-past four o'clock, the arrival of the President of the United States at the Navy Yard was announced by the discharge of artillery, and shortly after a sound resembling the far-off discharge of a cannon notified to the spectators that the anxiously looked-for experiment had commenced. Every eye was turned towards the Branch, from which an immense body of water was seen to arise in the air about 50 feet, resembling a gigantic and magnificent jet-d'eau motion, the U. S. was lowered, the cable slipped, and the vessel slowly and gracefully moved towards the submerged battery. When within a few hundred yards of the battery, the commander and crew left the barque in a boat, and a rocket was sent up from the latter as a signal that they were in safety. Almost immediately two batteries were discharged, in quick succession, a few yards from the vessel, which agitated the water tremendously, and threw up great quantities of mud from the bottom. The vessel, however, kept steadily on her course, and on arriving at the designated spot, another battery exploded, and the graceful ship which had a moment before "walked the water like a thing of life," was a huge, ill-shapen wreck. The battery had struck her directly under her foremast, tearing her bow to atoms—what remained of the wreck immediately settled to the bottom of the Branch. She was then boarded by Lieut. Boyle, and the U. S. again raised, (probably to indicate to the occupants of the numerous boats in the vicinity that the wreck was not literally public property.) With another explosion, such as we have attempted, the crowd dispersed in every direction, all appearing fully satisfied with their entire success.

The Kanawha Salt Region.—We have said before that the subterranean wonders of the Upper Kanawha Valley were not half explored, and every day proves that there are not only mysteries, but treasures of wealth, of which the preceding generation had no conception. When, a year or so ago, Mr. Tomkins turned out the *gas*, that forced up water under the kettles to aid in converting the brine into salt, thereby saving one-half of the fuel, it was thought to be a vast stride in the march of improvement and discovery, but now Messrs. Warth and English at their new furnace have actually attained the Irishman's desideratum in the proposed purchase of two stoves—*they save all the fuel.* The gas has sufficient power to force a column of water 3 inches in diameter, from the depth of a thousand feet to the height of about 50 feet above the surface of the earth. It is then turned under the furnace, ignited, and boils the water till it is brought to the state for crystalization, and then conveyed to the cisterns, and produces the heat that carries on the process of evaporation. Thus, 350 bushels of salt of the first quality are made per day, without one particle of other fuel than the gas. At these works but one cistern is yet erected, and they are able to use only one-half of the water that is forced up; another is in progress of erection, when completed all the water will be used, and 70 or 80 barrels of salt manufactured daily, without coal, wood, or the rays of the sun.—*Boston Journal.*

Important Discovery in the Manufacture of Iron.—A discovery has lately been made by Mr. Simeon Broadmeadow, of New York, in the manufacture of iron, by means of which the iron ore is by only one process converted into wrought-iron, without being first made into pig-iron, and at a less expense than the pig-iron can be made. The iron ore is placed upon the floor of a reverberatory furnace, the flame of the fire passing over it; when a chemical compound is used to unite the elements of the iron by separating the *slag* entirely from it. By this first, only operation, the wrought-iron comes out as perfect, in every respect, as that by the double operation of *puddling* and piling pig-iron, and, for the purpose of manufacturing steel, even surpasses it. By this process, wrought-iron of the best quality can be produced at a cost not exceeding *twenty-five dollars and a half* per ton. To make the iron ore into balls of wrought-iron will require no blast, nor machinery of any kind; the anthracite or bituminous coals being used with equal advantage in a common air furnace, a good draft being all that is wanted. These balls of wrought-iron can be made at a good profit (if the furnace is built near the mines of mineral and coal) for *fourteen dollars* per ton.—*New York Tribune.*

The "Great Britain."—The American papers state that "the Board of Aldermen of the city of New York have unanimously adopted a resolution in favour of allowing Nathaniel Pierce to extend the pier at the foot of Clinton-street, 70 feet further into the river, so as to be of sufficient capacity to accommodate the iron steamer, *Great Britain*, on her arrival at that port."

Propagation of Sound.—When the ground is hard and dry, or rests upon a continuous stratum of rock, sound is propagated to a great distance, and hence it is the practice in many countries to ascertain the approach of horsemen by applying the ear to the ground; the sound of cannon has been heard at a great distance; guns discharged at Carlscrona were heard as far as Denmark—a distance of at least 120 miles. In sailing from Asia Minor to Egypt, Dr. Clark heard the sound of a sea-fight at a distance of 130 miles; Dr. Hearn heard guns fired at Stockholm, in 1685, at the distance of 180 British miles; and the cannonade of a naval engagement between the Dutch and English, in 1672, was heard across England, as far as Shrewsbury, and even in Wales, a distance of above 200 miles.—*Quarterly Review.*

Continental Coal Districts—Sambre and Meuse Railway.—From two Reports which have been published on this projected railway—one by Mr. Sopwith, the eminent economical geologist, and the other by Mr. Cubitt, C.E.—we glean the following remarkable, and, we dare say, to many novel facts respecting the mineral riches of the districts which it is intended to traverse. First there is a coal basin, extending over an area of upwards of 600 square miles; the produce of which amounted in 1842 to upwards of 3,059,183 tons, being more than three-fourths of the entire quantity of coal raised in Belgium. Mr. Sopwith states that, "as compared with its superficial area, Belgium possesses nearly the same relative area of coal deposits as Great Britain!" Next there are fields of iron ore, which are of almost inexhaustible abundance, and which, though as yet only partially worked, yielded, before the late depression in the iron trade of Belgium, 569,827 tons annually. Slate quarries follow, producing sixty millions of slates per annum; with beds of limestone and marble, to the productiveness of which it seems impossible to set limits. Besides furnishing an outlet for these vast stores of mineral wealth, the projected railway will form a most valuable medium of communication, not only between the numerous towns and villages which it touches, or comes within an available distance of, but between the principal ports and cities of Belgium and the manufacturing towns of the Ardennes. It will be connected also with lines of railway, now either in progress or projected, to Paris on the one hand, and to the Upper Rhine and Switzerland on the other. On the whole we know of no foreign railway which offers better prospects to investing capitalists. Both Mr. Sopwith and Mr. Cubitt agree in estimating the net receipts as equal to 9½ per cent. on the capital required for its construction.

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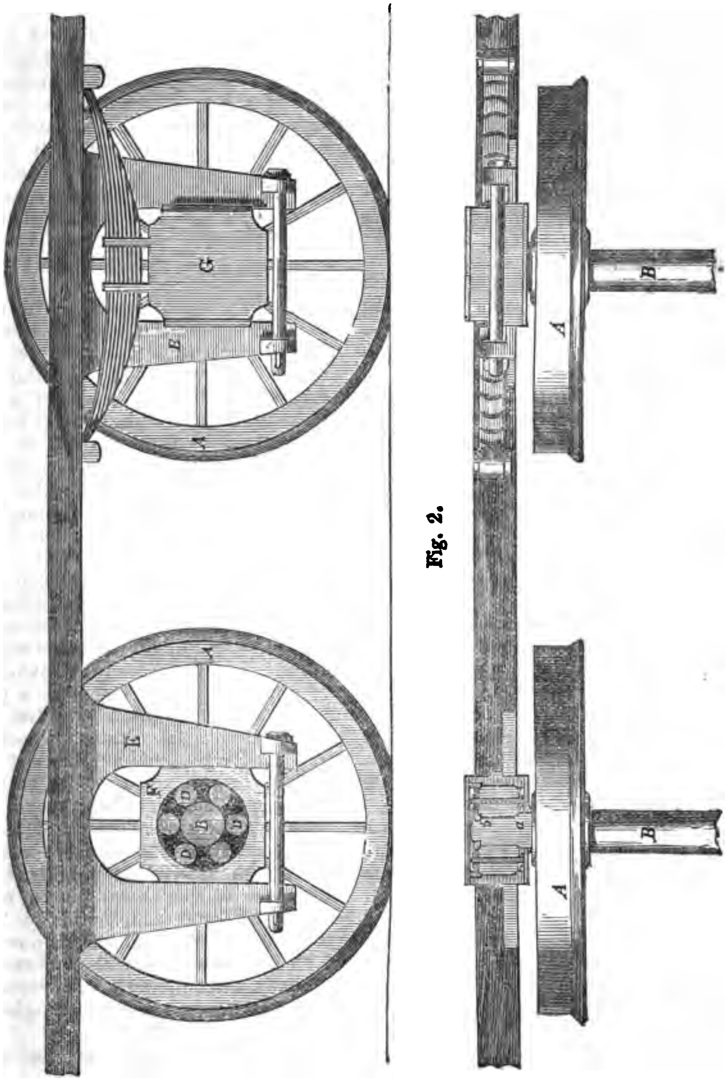


ROWAN'S PATENT ANTI-FRICTION AXLES.

Fig. 1. Fig. 2.

ROWAN'S PATENT ANTI-FRICTION AXLES.

[Patentee, William Rowan, of the firm of Messrs. Rowan and Sons, Doagh Foundry, near Belfast. Patent dated, Nov. 7, 1843; Specification enrolled, May 7, 1844.]

In Brewster's edition of Ferguson's Lectures, published nearly forty years ago, surprise is expressed by the editor at the neglect into which friction wheels had then fallen, and Walker, the popular lecturer of that time, is sharply reproved for having spoken of them with derision, in the teeth of the recorded opinions in their favour of Euler and other distinguished philosophers. "We are of opinion," says Dr. Brewster, "and we presume that every person who understands the subject will agree with us, that friction wheels, if properly executed, are of immense service, and that nothing but the ignorance or narrowness of the proprietors of machinery could have prevented them from being more generally adopted." The degree of service, however, which they can render is by no means equal under all circumstances. In the case of wheel carriages for the conveyance of goods and passengers on common roads, where, on account of the great friction to be overcome, they might seem to offer the largest possible advantage, they are perhaps of the least. For, the friction wheels can be applied to the axles only, and the axle friction in such cases, compared with that which arises from the contact of the peripheries of the wheels with the ground, and from the various jolting motions caused by the inequalities of the ground, is relatively so small as to be hardly worth caring about; besides which, the jolting motions referred to, are apt to put very soon out of order any sort of friction wheels that can be made use of.. The smoother, of course, the road is, and the more even and uniform the motion of a carriage upon it, the greater the advantage to be derived from friction wheels; and the best case of all for their employment is that where the periphery of a wheel has the friction of the air only to encounter (as in fixed machinery), and the only solid rubbing surfaces are those of the axle and its bearings. Although, therefore, it is not to be wondered at that common road travelling has benefitted so little by the invention of friction wheels, it is to us a matter of wonder that on railways, where the periphral friction has been so amazingly reduced in amount, and the jolting friction also, though not certainly in the same proportion, friction wheels should be still unemployed. We will mention an experiment which we witnessed with our own eyes, which will show that, supposing a line of rails to be perfectly smooth and level, the resistance to the motion of a carriage upon it may be actually reduced, by the adoption of friction wheels, by full nineteen-twentieths, that is to say, that one-twentieth of the motive power now ordinarily employed would suffice to do the same work!

The experiment was made with models of a carriage and railway, on a scale of half an inch to a foot; but we see no reason to anticipate any material difference of result from trials on a larger scale. The model of the carriage consisted of a framework with two sets of wheels and axles attached to it, one on the common construction, and the other on the anti-friction plan of Mr. Rowan, which we are about to describe; but both of precisely the same sizes and weights. The two sets were placed one over the other, so that, after experimenting with one set, by turning over the carriage frame, a trial might be made with the other. The model railway having been adjusted by a spirit gauge to a perfect level, the carriage model was first placed upon it with the common wheels and axles undermost, and a number of heavy articles heaped upon it. A scale pan attached to a cord carried over a pulley at the end of the railway, and attached to the front of the carriage, was then filled with ascertained weights, till the train (so to speak) was put in motion. The weight required to do this was 20¾ oz. The same experiment was then repeated with Mr. Rowan's wheels and axles undermost, when the train was drawn along with the greatest ease by a single ounce weight.

It is not to be expected that so immense a gain could be realized in practice on any railway ever yet constructed; for

Fig. 3.

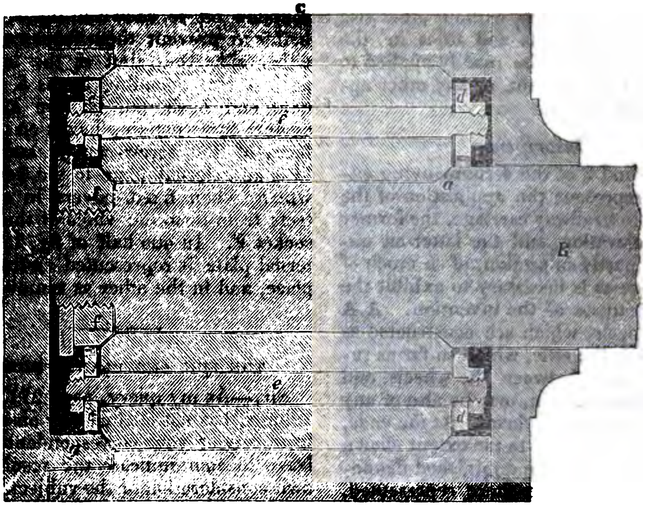
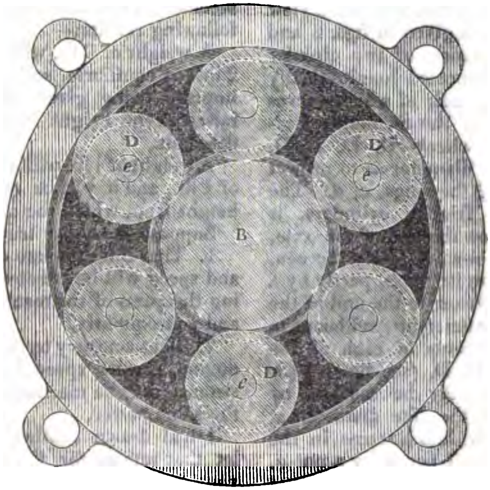


Fig. 4.



there is no railway in actual work so smooth and even as the miniature railway with which the preceding experiment was made. But a margin of nineteen twentieths is a large one to deal with; so large, that it must afford, we should imagine, room for every deduction that can be required to be made on account of unevenness in rails, bad joinings, &c, and yet leave a residue of advantage, ample enough, to make its attainment an object of the first importance to railway proprietors. If but a net gain of one-third remain, it would in some cases double the present dividends, and in others, be the source of a dividend where now there is none.

From the description which follows of this very ingenious invention, it will be

seen that the patent anti-friction appendages can be fitted or removed from the axles in a few minutes, without otherwise disturbing the wheels and axles in the least, and may also be readily applied to carriages of the present, or any other approved construction.

Description.

Figs. 1 and 2 of the accompanying engravings represent the application of the invention to a railway carriage, the former being an elevation, and the latter an under-plan, partly in section, of so much of the carriage as is necessary to exhibit the peculiar features of the invention. A A are the wheels, which are constructed as usual. B is the axle, which so far as regards the part between the wheels and their bearings therein, may be also of any known and approved form. At the ends, the axle is prolonged to the extent shown in figure 2, but of the diminished diameter from *a* to *b*, also there represented. To each end there are attached the parts following, marked C, *c*, *d*, *e*, D, *f*, *g*, E, F, G, *h* and *i*. C is a friction-cylinder or wheel carrier, of which a separate view in plan and section is given in figs. 3 and 4. This carrier consists of two circular rings, *c* and *d*, connected longitudinally by six bars, *e*, *e*, each of which serves as an axis to one of the six hollow friction cylinders or wheels D, D, D, D, which are of such diameter as to project a little way beyond the rings, *c*, *d*. The carrier, with its friction cylinders, is slipped loosely upon the end of the axle, so that both may revolve freely thereon. It is then secured in its place, partly by a cap *f*, which screws on to the end of the axle, and is of diameter just sufficient to overlap small segments of each of the friction cylinders D, D, (see fig. 1,) (or instead of this it may be secured by means of a cap of the like diameter at top, made to screw into a recess in the end of the axle,) and partly by a nut *g*, which fits into a recess in the outer end of the bush F, afterwards described. E, is a metal bearing, which is secured to and projects downwards from the framework of the carriage, having a bush or socket F, through the centre of which the end of the axle is passed, and within which the friction cylinders and carrier revolve—the friction cylinders revolving on the inside in contact with the axle B, and on the outside in contact with the interior of the socket F. The ends of the friction cylinders are bevilled or rounded off as shown in fig. 2, and the better to prevent them from swaying to either side, they abut at the inner end against corresponding bevils *h*, *i*, in the axle and bush, and at the outer end against corresponding bevils on the inner faces of the screw-cap *f*, and nut *g*. G is an external plate to the bearing E, which, when fixed, covers in and protects from dust the whole of the bush or socket F. In one half of fig. 1, this external plate is represented as fixed in its place, and in the other as removed.

THE SUN AND PLANET MOTION.

Sir,—As my query, page 271, current volume, has not elicited any observations from any of your correspondents, I beg leave to communicate the result of my own consideration of the subject.

I imagine that a principle or principles contained in this movement (sun and planet) when ingeniously carried out by mechanical construction will produce the following results:—

A weight of 1 lb. will hold a weight of 2 lbs. in equilibrio, and a small additional impulse being given, the 2 lbs. will be raised to the height from which the 1 lb. descends.

A weight of 1 lb. will overcome a weight of 1 lb., and it will be raised to twice the height from which the other descends.

Suppose the above true, it follows—

1. That intermediate degrees of power and speed will be effected by proportioning the parts of the machine accordingly; and consequently,

2. That contrary to the long-cherished dogma, greater speed in overcoming resistance may be mechanically obtained by the same power.

I had drawn another conclusion, but let that remain for the present: I think your readers will think what I have already advanced to be too large to swallow, and I think they will find it too hard to bite; for my own part, I have been masticating it for upwards of two years, and at last, have been able to bolt it.

Yours, &c.

HEZRON.

ON THE APPLICATION OF SUM AND DIFFERENCE LOGARITHM TABLES.—PART I.

Sir,—In the year 1812 appeared in Germany, in the 26th volume of Zach's *Monatliche Correspondenz, etc.*, a logarithmic table of a peculiar form, devised and constructed by the celebrated astronomer Gauss. This table, as republished by Pasquich, at Leipzig, in 1817, along with the common tables, in a small octavo volume, bearing the title, *Abgekurzte Logarithmisch Trigonometrische Tafeln, etc.*, is now before me; as is also a second table, of the same form, but more than ten times the extent, published at Altona, in the same year, in a thin 4to volume, by E. A. Matthiessen, under the title: *Tabula ad Expeditiorem Calculum Logarithmi Summæ vel Differentiæ Duarum Quantitatum, per Logarithmos Tantum Datarum.* In what follows, I refer to Matthiessen's Table, as being the more complete.

This table enables us, when two logarithms are given, to find the logarithm of either the sum or the difference of the corresponding numbers, without knowing those numbers themselves. For example, log. a and log. b being given, the table enables us, by a simple operation, to find either log. $(a + b)$ or log. $(a - b)$, without the preliminary labour of finding a and b. This property is of vast use for the abbreviation of labour in calculations of various kinds. But, with the single exception of your able and ingenious correspondent, Mr. Woollgar, I believe no English calculator has hitherto availed himself of the facilities this table affords. Mr. Woollgar states, in a note to his recent publication on Friendly Societies, that the valuable tables appended to that work were calculated by means of this table; and he refers to it also in a communication addressed to yourself, and inserted at page 34 of your 14th volume. The circumstance that these brief references are the only intimations of the existence of this table, accessible to the English reader, may suffice to account for the neglect it has experienced. It, therefore, appears to me that a service will be rendered to science, by presenting, through your pages, a brief description of the table and its properties, exemplified by a few practical examples, and thus directing attention more pointedly to the subject. This is what, with your permission, I shall attempt in the following pages.

In the outset I must remark, that it is from Mr. Woollgar, as the first to call attention to Matthiessen's Table in this country, and as eminently qualified to do justice to the subject, that an exposition of the uses of the table would with most propriety have proceeded. And it was at one time the intention of that gentleman to have undertaken the task. But the necessary leisure and convenience not having been afforded him, it is that the performance may be no longer delayed that, after some hesitation, and with his approval, I have undertaken it. My papers (excepting this introduction) will, however, have the benefit of his revision.

Matthiessen's Table occupies 212 pages, and the volume contains about 26 pages, besides, of introductory matter in Latin and German. The last-named portion of the work is chiefly occupied in describing the methods employed in the construction of the table; but nothing is said as to its most striking applications, nor as to the mode of interpolating values intermediate to those given. It will, therefore, be proper to go a little further into detail than might otherwise have been necessary.

The form of the table will be understood from the specimen page herewith given. (See p. 390.) The table consists of three principal columns, A, B, and C, and two smaller columns. The numbers in the table are logarithms of 7 places, of which the first 4, with the index, are given in the columns A, B, C. The remaining 3 places of column A are in every case cyphers, and the remaining 3 of both B and C, being from the nature of the table always alike, are contained in the subsidiary column headed "B and C." Thus, the first value of A, in the specimen page, is 1·0300,000, and the corresponding values of B and C are 0·0387,494 and 1·0687,494. The column headed "P. P." contains the differences of columns B and C, with proportional parts, as in the common tables, adapted to each.

The fundamental relation between the corresponding values in columns A, B, and C, is as follows:—Let corresponding values in the several columns be denoted by A, B, and C, respectively. Then

A.	B.	C.	B. et C.	P.	P.	A.	B.	C.	B. et C.	P.	P.
1·0300	0·0387	1·0687	494	B.	85	1·0350	0.0383	1·0733	249	B.	84
1	7	8	409	1	9	1	3	4	164	1	8
2	7	9	324	2	17	2	3	5	080	2	17
3	7	90	239	3	26	3	2	5	996	3	25
4	7	1	153	4	34	4	2	6	911	4	34
1·0305	0·0387	1·0692	068	5	43	0·0355	0·0382	1·0737	827	5	42
6	6	2	983	6	51	6	2	8	742	6	50
7	6	3	897	7	60	7	2	9	658	7	59
8	6	4	812	8	68	8	2	40	574	8	67
9	6	5	727	9	77	9	2	1	489	9	76
1·0310	0·0386	1·0696	642	C.	915	1·0360	0·0382	1·0742	405	C.	916
1	6	7	557	1	92	1	2	3	321	1	92
2	6	8	471	2	183	2	2	4	237	2	183
3	6	9	386	3	275	3	2	5	152	3	275
4	6	1·0700	301	4	366	4	2	6	068	4	366
1·0315	0·0386	1·0701	216	5	458	1·0365	0·0381	1·0746	984	5	458
6	6	2	131	6	549	6	1	7	900	6	550
7	6	3	046	7	641	7	1	8	816	7	641
8	5	3	961	8	732	8	1	9	731	8	733
9	5	4	876	9	824	9	1	50	647	9	824
1·0320	0·0385	1·0705	791			1·0370	0·0381	1·0751	563		
1	5	6	706			1	1	2	479		
2	5	7	621			2	1	3	395		
3	5	8	536			3	1	4	311		
4	5	9	451			4	1	5	227		
1·0325	0·0385	1·0710	366			1·0375	0·0381	1·0756	143		
6	5	1	281			6	1	7	059		
7	5	2	196			7	0	7	975		
8	5	3	111			8	0	8	891		
9	5	4	027			9	0	9	807		
1·0330	0·0384	1·0714	942			1·0380	0·0380	1·0760	723		
1	4	5	857			1	0	1	639		
2	4	6	772			2	0	2	555		
3	4	7	687			3	0	3	471		
4	4	8	603			4	0	4	387		
1·0335	0·0384	1·0719	518			1·0385	0·0380	1·0765	304		
6	4	20	433			6	0	6	220		
7	4	1	348			7	0	7	136		
8	4	2	264			8	0	8	052		
9	4	3	179			9	79	8	968		
1·0340	0·0384	1·0724	094			1·0390	0·0379	1·0769	885		
1	4	5	010			1	9	70	801		
2	3	5	925			2	9	1	717		
3	3	6	841			3	9	2	633		
4	3	7	756			4	9	3	550		
1·0345	0·0383	1·0728	671			1·0395	0·0379	1·0774	466		
6	3	9	587			6	9	5	382		
7	3	30	502			7	9	6	299		
8	3	1	418			8	9	7	215		
9	3	2	333			9	9	8	131		
1·0350	0·0383	1·0733	249	Diff.		1·0400	0·0379	1·0779	048	Diff.	

if $A = \log. m.$

$B = \log. \left(1 + \frac{1}{m}\right)$

and $C = \log. (1 + m.)$

From this it follows, that, since $\log. m + \log. \left(1 + \frac{1}{m}\right) = \log. m\left(1 + \frac{1}{m}\right) = \log. (1 + m)$, we have generally, $A + B = C$. Thus, in the case of the logarithms above, we see that $1{\cdot}0300000 + 0{\cdot}0387494 = 1{\cdot}0687494$.

In the principal part of the table, occupying 200 pages, and to which alone my remarks have reference, A increases from 0·0000000 to 2·0000000, by a constant difference of ·0001000. Consequently, in virtue of the fundamental relation, C also will increase, and B will decrease, but not by constant differences. It is easily shown that the sum of any two corresponding differences of B and C, is equal to the constant difference of A. In the specimen page we see that,

$85 + 915 = 1000,$

and $84 + 916 = 1000.$

The operation in using the table is, to seek for a given logarithm in some one of the columns, and to take out the corresponding logarithm from either of the others. This operation in regard to finding C from A, or the converse, is precisely similar to the methods employed with common logarithmic tables; but the operation of mutually deducing A and B, or B and C, is not quite so simple. I have, therefore, arranged in a small table all the cases that can occur.

Suppose that we have a logarithm given which is not to be found exactly in its appropriate column, which may be any one of the three, and that the logarithm corresponding to this in either of the other columns has to be taken out. Let A, B, or C, as the case may be, denote the next less logarithm in the appropriate column, and A′, B′, or C′, the next greater in the same column. Also, let e denote the excess of the given logarithm over the next less in the appropriate column, and e' its defect from the next greater. Then will the given logarithm be equally denoted by $A + e$ and $A' - e'$, $B + e$ and $B' - e'$, or $C + e$ and $C' - e'$, according as it has to be sought in column A, B or C. Moreover, let ΔA, ΔB, and ΔC denote the printed tabular differences, so that $A' - A = \Delta A$, $B' - B = \Delta B$, &c. Then will the following table show how the interpolation may in all cases be effected, each of the three columns being in turn the argument.

When the argument is	The corresponding logarithms in the several columns are		
	in A	in B	in C
Col. A	$A + e$	$B - \frac{e \Delta B}{\Delta A}$	$C + \frac{e \Delta C}{\Delta A}$
	$A' - e'$	$B' + \frac{e' \Delta B}{\Delta A}$	$C' - \frac{e' \Delta C}{\Delta A}$
Col. B	$A - \frac{e \Delta A}{\Delta B}$	$B + e$	$C - \frac{e \Delta C}{\Delta B}$
	$A' + \frac{e' \Delta A}{\Delta B}$	$B' - e'$	$C' + \frac{e' \Delta C}{\Delta B}$
Col. C	$A + \frac{e \Delta A}{\Delta C}$	$B - \frac{e \Delta B}{\Delta C}$	$C + e$
	$A' - \frac{e' \Delta A}{\Delta C}$	$B' + \frac{e' \Delta B}{\Delta C}$	$C' - e'$

The table exhibits two solutions for each case, the correction being in the one solution additive, and in the other subtractive. The *affection* of this quantity is determined by the form used for the given logarithm, that is, $A + e$, or $A' - e'$, &c. It is generally preferable that the correction should be additive,

and it will always be so if attention is paid to the following precepts:—When columns A and C are used together, take in the argument column that value which is next *less* than the given logarithm; but when column B is used, with either A or C, take in the argument column that value which is next *greater* than the given logarithm.*

When column A is the argument column, it is easy to see, that e will be the number composed of the last three figures of the given logarithm, and that e' will be the complement of this number to 1,000. It is in the same circumstances that the printed proportional parts admit of most direct application.

What precedes is but preliminary matter. In another communication I shall go farther into the subject. Meanwhile,

I remain, Sir, yours respectfully,

G.

Hermes-street, Pentonville, June 3, 1844.

* In using Astronomical Tables, care is taken to make the correction for intermediate values always additive; and I am indebted to Mr. Woollgar for the idea of applying the principle on which this is done for the same purpose in the use of Matthiessen's Table.

OBSERVATIONS AND EXPERIMENTS ON THE CHEMICAL ACTION OF LIGHT; PARTICULARLY IN REFERENCE TO DETERMINING WHETHER ITS ADMITTED DEOXIGENATING POWER DOES NOT DEPEND ON ITS CONTAINING A VERY MINUTE PORTION OF HYDROGEN.

BY HORATIO PRATER, ESQ.

It seems to be now considered as established, that light has a deoxigenating power. Thus some of the oxides of mercury and lead become lighter when exposed to a bright light, and the white salts of silver blacken under such circumstances, and the oxide is more or less reduced. Oxide of silver also, when exposed to the light, gives out a part of its oxygen, and oxide of gold under the same circumstances is completely reduced, even by light of day (Berzelius, tom. iii.) A solution of gold also so situated, deposits gold on the sides of the glass, and a solution of nitrate of silver blackens by exposure to light; it also is, at least in part, disoxygenized. When chlorous acid too is exposed to light, the oxygen is separated from the chlorine, (Berzelius, tom. ii.) Light, indeed, is said by Tiedemann in his Physiology to separate oxygen from leaves when these are cut in small pieces, but not if bruised into a pulp; and although, if this be true, we shall be obliged to admit that it is chiefly by means of the organization of the leaf that light can disoxygenize in this case; still, as light is necessary for such effect, light, even in this case, is properly considered a disoxygenizing agent, since it obviously enables vegetable life to effect a chemical change, that by mere life and organization alone could not be effected.*

From the experiments of Sir H. Davy, (Chemical Philosophy, *Art.* Light,) it seems not improbable that light may really produce its disoxygenating effect from containing a *very minute* portion of hydrogen:—

These experiments seem to confirm the general principle that light has a disoxygenating effect, and more particularly the rays at the violet end of the spectrum, where the heat is the least; for at this end oxygen was most speedily *separated* from water by chlorine; and at this end moistened red oxide of mercury was also partially disoxygenized, or "acted on as by hydrogen gas." Scheele, and after him Senebier, says Thomson (on Heat, edit. 2, p. 119), found that the oxides of gold and mercury are not reduced at the red, but only at the violet end of the spectrum, and chloride of silver was only blackened at this end and beyond it. It is at this end, too, according to Thomson, that *etiolated* plants regain their green colour, (an effect, we may presume to depend on the separation of oxygen—disoxygenation,) the red end having "but little or no effect."

Now although there are some exceptions and anomalies on this point,† all

* Independent of its disoxygenating effect light produces other effects on the organization. Thus it seems to have an influence in determining the form; for Dr. Edwards found tadpoles were not changed to frogs when kept in a dark place.

That light produces other changes beside disoxygenation is no proof that it should not still properly be considered a disoxygenating agent. Thus it makes chlorine and hydrogen unite when these gases are exposed to it; or when the chlorine is dissolved in water. In the same way it makes chlorine and carbon unite when carburetted hydrogen and chlorine gases are mixed, or when chlorine and carbonic acid are exposed to it. It makes hydrogen and nitrogen unite when hydrocyanic acid is exposed to it, the carbon gradually precipitating.

† It must be admitted, however, that according to these experiments, puce-coloured oxide of lead seems a direct exception from the principle of the violet being the disoxygenating end of the spectrum, for this was partially disoxygenated in the red rays, but not affected in the violet. The same

the above considerations taken together warrant us in regarding light as more peculiarly a disoxygenizing agent, and in considering that this property resides more especially at the violet end of the spectrum.

The reasons for supposing that the deoxygenising power of light depends on its containing a *very minute* portion (for as light is imponderable, such it must be) of hydrogen, are the following:—Although there is nothing impossible in this being the case with the light which seems almost an essential property of heat at a certain temperature (for oxygen and hydrogen exist in plants in the proportion to form water, yet do not form it), I intend the following observations to apply more especially to light which is produced as distinct from heat, and often exists, as in the light of phosphorescent bodies, and in the light of the moon, without it; for I think it very probable that such light, and the light, so to speak, of heat, are perfectly different; or, admitting them the same, we must admit that the light of heat is distinct from heat (though produced by it), as it may be separated by the prism, and form into *distinct and independent* rays.

It appears from Sir H. Davy's experiments, that the same change was produced on puce-coloured oxide of lead by exposing it to a current of hydrogen gas as by the red rays; and on moistened red oxide of mercury as by the violet rays;* that is to say, hydrogen deoxidizes, or partially deoxidizes, the oxides of lead and mercury at the *temperature* of the air; as no doubt it would do those of gold, silver, &c., as well as the solutions of these metals; for Mrs. Fulhame found it threw down metallic silver. In short, all that can be deoxidized by light can probably be deoxidized by hydrogen; since this gas can even partially deoxidize carbonic oxide at a red heat, and iron wholly at a heat below redness. Professor Daniell (Phil. Trans., 1836) seems to show that zink prevents the oxidation of copper when put in contact with it, by causing its surface to be covered with hydrogen gas—a proof how strong is the affinity of this gas for oxygen; hence how well calculated it is for explaining the deoxidizing effects of light.

2. The chemical or deoxidizing rays are not visible (for they are rather beyond than at the violet end of the spectrum) nor calorific. But surely they must be material, although imponderable on account of the want of delicacy in our balances. Taken, then, in conjunction with their disoxygenating effect, of what are they so likely to be composed as a very minute quantity of hydrogen in conjunction with a particular sort of ether, seeing that *hydrogen is the lightest substance known?*

3. Light is a bleaching agent (admitting the singular exception in regard to bodies possessed of life, for it tends to darken the colour of the human skin, and to give the green colour to vegetables, since growing in the dark these are white). Hydrogen, indeed, is not, generally speaking, a bleaching agent; yet

with the black oxide of mercury, not affected in the violet, but apparently more oxygenized in the red, instead of disoxygenized. Again, Dr. Wollaston found gum guaiacum changed to green, or oxygenized at the violet end of the spectrum, but not at the red (Henry's Chemistry, art. *Light.*) Thus the violet end oxygenizes in this case, and disoxygenizes in many others; and the red end oxygenizes in the case of black oxide of mercury, and according to Dr. Henry in the case of phosphorus.

These last two experiments are hardly sufficient to warrant us to deduce from them the principle that Dr. Henry has deduced, viz., that the red end of the spectrum tends to oxygenize matter. However, this appears, from Sir H. Davy, to be the case when the black oxide of mercury is used, and seems not dependent on the heat (as may be in the case of phosphorus), for I kept this oxide some minutes at the heat of boiling water without finding it to redden. The effect only took place when the heat of a spirit lamp was directly applied to the tube; but it is right also to state that this oxide did not redden by exposure for many hours to the light of a very bright day; yet it was perfectly black, having been prepared by potass in excess, or calomel. When the oxide was prepared by lime-water the result was the same. Dry or moist it was not *at all* reddened by boiling in water or by the sunshine at the beginning of April, yet muriate of silver in the same light was soon blackened. I have thought it right to state the reason, because the heat was not great, although the light was.

As it may be possible the black oxide may redden in the red ray, and yet not in a bright light itself; I have only stated my results, without presuming to doubt the correctness of Sir H. Davy's assertion; or even that of Mr. Donovan, who seems to consider that a bright light reddens slightly the black oxide of mercury. All I can say is the light tried by me had not this effect.

* It is right to state that I did not perceive the colour of these oxides to change (whether they were used dry or moistened) when a stream of hydrogen was passed over them for about five to ten minutes, even although the oxides were slightly heated. But as a considerable quantity of air was mixed with the hydrogen, in my experiments, and as the action was not continued longer than five or ten minutes, I must put the greatest confidence in the results of Sir H. Davy above mentioned. It seemed to me, however, that dry chloride of silver was slightly blackened by hydrogen.

Dr. Kane says, in his letter to M. Dumas, (Journal de Chemie, Med. Jan., 1840,) orceine is bleached by nascent hydrogen, though not by chlorine. Hydrogen, then, is sometimes a bleaching agent; but the *peroxide* of hydrogen seems peculiarly and properly so considered. But if light contains a very minute quantity of hydrogen, it is probable that deutoxide or tritoxide (if such there be) of hydrogen is continually forming by the action of light on certain substances, and that it is to this agent that light owes its bleaching quality;* and it is singular, in reference to this point, that deutoxide hydrogen decomposes the oxides of gold and silver,—light, as we have already observed, doing the same.

4. I found light to blacken *perfectly dry* chloride of silver as soon as it did the moist chloride. I also thought that a stream of hydrogen gas, as already observed, slightly darkened dry chloride of silver. I have likewise found that light discolours the dry red oxide of mercury as soon, or rather sooner, than it does the moistened oxide. In these cases, therefore, the hydrogen of water can take no part in the separation of chlorine, or in disoxygenation. Hence the increased probability of light containing hydrogen.

5. Again, the peculiar action of light on chlorine† is all in favour of the same hypothesis. As light tends to separate oxygen from its combinations, so, likewise, does it tend to separate chlorine, as the decomposition of the chloride of silver by light shows. But, as oxygen has a great affinity for hydrogen, so likewise has chlorine. Does not the hydrogen of light, then, tend by its affinity to give the first impulse towards the separation of chlorine in this case, and also when chlorine and hydrogen unite in the form of gas, or when chlorine unites to hydrogen by decomposing water? Or even when chlorine unites with carbonic acid gas, or when chlorine unites with carbon in the chlorides of carbon? May not, we ask, this presumed small portion of hydrogen, by its permeating as a part of light all the above mixtures, tend to give the first impulse to combination—much in the same way as the presence of air, or the addition of a crystal favours crystallization. The conditions being present for an action to take place, that action, sometimes, as in the case just noticed, does not take place until commenced by some extraneous cause; but *when commenced*, of course it will necessarily soon extend through the whole mass.*

This reasoning obviously applies well to light promoting the union of hydrogen and chlorine; but I apprehend it will also apply to light, favouring the combination of chlorine and carbon. There may be a minute portion of muriatic-acid gas (or perhaps some other compound of chlorine and hydrogen with a smaller proportion of hydrogen) formed in these cases, too minute even to be detected by "analysis," and yet sufficient to cause chlorine and carbon to unite, on the principle of crystallization commencing in the case just mentioned; for here, be it observed, motion, or one and a *different action* tends to make another and a different action commence. To be sure, it may be urged, that on this principle, light may only act by agitating the particles, and bringing these closer together; but I think on reviewing the whole of its chemical influences, we shall consider that it rather acts by *beginning* a chemical action itself; for on mere mechanical principles it is almost impossible it should be able to separate oxygen from a *dry* oxide (for here can be scarcely any motion impressed on the atoms) as I have already observed it does

* Perhaps, also, chlorine itself owes its bleaching power to the same cause; for dry chlorine gas does not bleach, and more or less of the deutoxide of hydrogen is probably always formed (according to the quantity of light,) when chlorine gas is dissolved in water. This view is also supported by the bleaching power of chromic acid; since this can only bleach by the agency of oxygen, direct or indirect.

† And we may add, bromine and iodine; though the action of light on these, particularly the latter, is less strong than on chlorine. And this again is what we should expect on our theory; since it is well known that the affinity of chlorine for hydrogen is the strongest: next comes bromine, and last iodine. Berzelius, indeed says (Traité tom. iv.) that the bromine of silver blackens by a light which is hardly strong enough to affect the chloride of silver. Supposing this the case, it may be possible that silver has not so strong an affinity for bromine as for chlorine. Hence the more easy decomposition by light of the former than of the latter; although generally speaking, chlorine seems to have a stronger affinity for hydrogen than bromine has. But Berzelius likewise asserts, that the iodide of silver is blackened "more slowly by the action of light than the chloride is." Now iodine is admitted to have a far less affinity for hydrogen, either than chlorine or bromine.

* Liebig has shown this principle to act in fermentation and putrefaction; and although I have elsewhere shown (*Lancet*, January, 1842,) it does not apply to the solution of an alloy of platinum and silver in nitric acid, as he conceived, I should think it would be likely to apply to light as an hydrogenating, and heat as an oxidizing agent, from the great *tendency to motion* of both these agents.

in the case of red oxide of mercury more quickly than when the same is moistened.

Take again the other action of light, viz., the decomposition of hydro-cyanic acid, and we shall find, that here again the action is on nitrogen, a substance which has a great affinity for hydrogen, (for ammonia seems almost always formed when iron is oxidated,) and hence we may conceive for light. Thus the carbon falls, as a more intimate union is commenced between hydrogen and nitrogen.

The reader will easily conceive (since so very small a quantity of hydrogen is presumed to exist in light,) why, when oxygen is separated from the oxides, the presence of deutoxide of hydrogen or water may not be detected by the best tests at present known. The hydrogen of light is only presumed to act in these cases by giving the *first impulse to an action disposed to commence*. Thus, extremely minute portions of these, the oxide of hydrogen, are supposed to be formed, and the separation of oxygen subsequently takes place rather from this excitation (so to speak) than its being abstracted by repeated fresh portions of hydrogen. The same is presumed to be the case with chlorine in the chloride of silver; and in this case Berthollet says expressly, that a portion of muriatic-acid gas is formed and given off. But in this case it seems probable, that the greater part of the gas given off is chlorine, and in the case of the metallic oxides, oxygen, just in the same way as oxygen, rather than deutoxide of hydrogen, or water, is the gas given off from plants; though in this case, some water must, no doubt, be likewise produced; but of course, whether any of it were produced from the hydrogen of light, could not well be ascertained experimentally.

Since, if hydrogen exist in light, the hydrogen may reasonably be expected to be modified by the continual *contact* of luminous and calorific ether (for though by the prism we can separate ether from the invisible or *hydrogen-containing* portion, they all still, in their natural state, exist together,) of course we may reasonably expect the hydrogen of light to have somewhat modified and exalted chemical affinity. As one end of the spectrum has *certainly* a disoxygenating power, and the other end, in *some* cases, an oxygenating power, light, *considered as a whole*, has probably a peculiar electric condition, which seems well worthy the attention of electricians, and such electric condition may have considerable influence in determining combinations and decompositions.

On reviewing the above observations and experiments in support of the deoxidizing power of light, it will be evident, that such power exists only in a very feeble, though very obvious degree. Thus it is chiefly the *easily decomposable* oxides that are disoxygenized by light: in fact, only those that are decomposed by a very low heat, or even without any heat at all, as the oxides or salts of gold.

Before finishing this Essay, a few somewhat unconnected observations and facts relative to the prismatic spectrum generally may be added.

The deoxygenating rays, certainly different from the calorific rays (for these are situated at the red extremity of the spectrum*), would appear also to be distinct from the *light-producing* rays properly and emphatically so called. For not only does Sir W. Herschell assert that the greatest intensity of light is in the centre of the spectrum, and that it decreases as we approach either extremity; but M. Berard concentrated, by means of a lens, all that part of the spectrum which extends from the green to the extreme violet, and by means of another lens, all that part which extends from the green to the extreme red. This last bundle of rays formed a white point so brilliant that the eyes could scarcely support the light, nevertheless, the chloride of silver remained exposed during more than two hours to that light, without experiencing any sensible change. But on exposing the chloride to the first bundle, of which the light was much less intense and *the heat less strong*, it was blackened in less than ten minutes. Again, Wollaston, Ritter, and Brockmann, found that the chloride of silver blackened still more when it was placed

* Phil. Trans., 1800. The calorific power augments, says Sir W. Herschell, in parting from the violet, and as we proceed towards the red, and is at its maximum a little beyond the red. Sir H. Englefield confirmed these experiments in 1802. Seebeck, to be sure, subsequently showed that the nature of the prism has an influence; and that the heating rays are found in every part of the spectrum from the yellow beyond the red rays. But his experiments still confirmed the general principle, that the heating rays are accumulated about the red end of the spectrum.

entirely out of the limits of the visible spectrum, beyond the violet ray.* These experiments will convince us that the chemical properties of light are not to be understood as residing, so to speak, in light; but to be in a measure distinct rays blended with those of light, and as they are consequently not visible, this seems an argument in favour of their being material, or consisting principally of hydrogen, as we have endeavoured to show.

I may now observe, that as far as I know, the opinion that light contains hydrogen, has not yet been broached. Dr. Henry indeed calls the violet rays "deoxidating *or* hydrogenating;" but a body may be deoxygenizing without containing hydrogen; and as I find no passage in his article on Light, in which he expressly states that light seems to contain hydrogen, I conclude he only means by the term "hydrogenating," acting *like* hydrogen gas, which no doubt the rays in question do, as Sir H. Davy concluded also from his experiments, without, certainly, broaching the opinion that hydrogen was an element of light.

The fact that heat, though almost universally an agent that tends to promote oxygenation, occasionally deoxygenates, (as is to be presumed without containing hydrogen,) seems no argument against light deoxygenating by means of hydrogen. For heat obviously tends to separate the particles of matter; although it at the same time, generally speaking, exalts the affinity for oxygen, still when this is not much exalted the former tendency will prevail, and the matter will be deoxygenated. Thus heat partially deoxygenates the peroxides of iron and manganese; but is unable to reduce them wholly. And it reduces the oxides of gold, platinum, and silver *wholly*,—because these metals have so slight an affinity for oxygen. The red oxide of mercury is formed at the boiling point of mercury; but the moistened oxide in my experiments did not appear to be decomposed by a heat of boiling water; nor the dry oxide below redness; and this point is generally admitted, so that in this case heat only disoxygenates, by the *forcible expansion*, at the point where the oxide is volatilized.

As the *motion* produced by heat is obvious, we should naturally expect that in some rare cases it would be able to disoxygenize solely by producing such forcible movements in the atoms of matter, and without acting by anything like chemical affinity. Now this we suppose to be the action of light, because it does not excite such violent efforts at expansion and movement.

That heat deoxidizes in the above cases is no objection to my theory of a red heat containing a minute portion of oxygen; for the quantity of oxygen presumed in this hypothesis to exist in heat would be wholly unappreciable, considering the quickness with which the metals above mentioned are deoxidized by it.

That the affinity of light for oxygen does not depend on the *heat* of the light, is proved by the deoxidizing end being the coolest, and also by the fact that red oxide of mercury is not deoxidized even when moistened at the heat of boiling water. Light, then, has a real chemical affinity for solid oxygen; since it separates this from its combinations, and seems itself to change it into a gas: for the heat it can gain from the surrounding media is surely not sufficient to effect this change.

By the same mode of reasoning, we shall also conclude that light has an affinity for chlorine; since it separates this from the chloride of silver.

It is singular that both these gases for which light seems to have so strong an affinity, are *supporters of combustion*;* and supporters, perhaps, in the same proportion as their affinity for light. For (as far as experiments have yet gone) light seems to have a greater tendency to *separate* oxygen in the form of gas from its combinations, than it has chlorine; and I apprehend oxygen must be considered a more powerful supporter

* Annales de Chymie, t. 85, p. 309. When chloride of silver blackened, muriatic acid, (rather chlorine,) and not oxygen, is given off, as Berthollet has remarked. (Journal de Physique, t. 56, p. 80.) Nevertheless, this is analogous to the separation of oxygen, as the fact that silver is reduced when chalk is dipped in solution of nitrate of silver, and exposed to light, shows. (Thomson on Heat, p. 119, Ed. 2nd.) Besides, as the blackened surface of the chloride of silver has been found to conduct electricity, the metal must be nearly or wholly reduced to the metallic state.

* This reasoning likewise applies to bromine and iodine, inferior supporters to chlorine indeed, but still seeming to have an affinity for light, since when the bromide and iodide of silver is darkened, bromine and iodine probably in a greater or less degree, go off in the gaseous state, *in union with light*.

of combustion than chlorine is, since oxygen will support not only the combustion of the metals, but also carbon in its various states, either as a simple substance, or in combination.

From this view of the subject it seems fair to infer that in combustion, the light comes more probably from the supporter than from the combustible. And if this view be correct, we shall be led to the belief that oxygen gas contains more light than any other gas; which light is given out when the oxygen is again solidified by combination.

As I know that some chemists consider the light to come from the combustible, I shall only observe that at present such opinion is by no means proved, and the opposite opinion seems the more probable. Perhaps, indeed, by subjecting different gases to compression the amount of light contained in each might be estimated. Would not oxygen give out the most?

Note.

In reference to the distinct nature of heat and light.

It is on Dr. Hulme's authority that I have stated in the text that heat does not accompany phosphorescence, so as to affect the thermometer: he showed this to be the case both with the light of putrifying fish, and also in Canton's pyrophorus.* Light then may exist perfectly independent of heat; and this we find in a great degree even in the sun, for the greatest light, says Sir W. Herschell, is about the centre of the spectrum, but the greatest heat at the red end.

* Phil. Trans., 1800. The absence of heat in the electric *spark* is probably also an illustration to the same effect.

RAILWAYS—HOW THEY MAY BE MADE CHEAPER.

Sir,—If the following observations upon the construction of railways possess any novelty worth entertaining, perhaps you will do me the pleasure of recording them in your very useful and instructive Magazine.

I fear that the proposition to which I am about to give expression will excite in many a smile at its apparent impracticability; but every one, however humbly acquainted with the mere rudiments of science, must know how great a part common gravity plays in everything connected with matter—whether it is seen in the fall of an apple, or the whirling of a globe—the fearful rush of a mountain torrent, or the frightful precipitation of a railway train down a decline—all bear witness to its capacity as a motive agent. We will see anon how it can be made subservient to the use of man in forming a railway.

I beg leave to observe that I found my presumption of the practicability of the following mode of constructing railways on experimental trials on various declinations, by which I have ascertained that the impetus of a decline invariably carries a carriage up an accline two-thirds; and I question not that where the decline extends a great distance, it will very nearly surmount the succeeding accline, though of the like elevation.

The Greenwich and the Croydon railways painfully illustrate the necessity of some more remunerative mode of transit than the present; and I am sure none is to be found save in the adoption of the decline and the accline mode. On this principle, and this principle alone, would I construct a railway.*

Suppose we take the Greenwich line, and see if we can construct it so as to supersede the use of locomotives, or any other motive agent whatever, saving always common gravity. We shall find that what they are now paying yearly for the cost and wear and tear of the locomotive department, and other expenses relating thereto, might be wholly saved, which would enable the proprietors to pocket a more remunerative dividend than they have hitherto received for the immense capital sunk.

We therefore, if you please, will have two stations, one at London Bridge, the other at Greenwich. Now let these stations be high—no matter how high (within building limits) or how grand and commanding—and let the stations at either end be of the same altitude. We

* Many of our readers will immediately perceive that this is by no means so novel a theory as the writer supposes—that it is, in fact, but a revival of the undulating system of the late ingenious Mr. Badnall, for which he took out a patent in 1832, and which was subsequently discussed at large in our pages. (See particularly *Mechanics' Magazine*, vols. xx., xxi., xxii., xxiii.) We insert our correspondent's communication nevertheless, because it may serve to recall attention to a mode of construction which has not received that attention which we think it deserves, and contains besides some very striking, and, it may be, useful suggestions.—Ed. M. M.

must have two lines, one to and one from Greenwich. We now for convenience will speak of the one to Greenwich, which is about three and a half miles long. For this length of line a 100-feet fall will be enough; but, to remove all doubt, say 130 feet, which will be amply sufficient, as in every mile there may be one or two undulations, which would not only tend to keep the speed of the carriage within bounds, but also cause the power derived from the fall not to be too soon expended. The rail line at London Bridge, we will say then, is 130 feet above the terminus at Greenwich. Now let this rail line run slopingly towards Greenwich thus:—Suppose the force of the 130 feet fall is expended in the first mile; here we shall have a great velocity, sufficient to surmount an accline two-thirds of a mile long, with a 60 feet rise, so that we shall now have 60 feet available, besides the already unspent impetus of the carriage to go down a mile of decline, which will carry us nearly three miles on our way towards Greenwich, leaving about a mile more for an accline with a 30 feet rise, which the carriage will eagerly ascend, on to a level platform, leaving 100 feet for the carriage to be drawn, by an endless rope or chain, up an incline sweep to the station at Greenwich, where it can be easily run across to the line for London. We must suppose that the moment a carriage has arrived upon the platform at the top of the 30 feet rise, it is yoked on to the rope, and drawn to the end of the platform out of harm's way, lest the succeeding carriage should come on to the platform ere the passengers have alighted from the carriage. When all the passengers have quitted the carriage, it can be drawn up the sweep by the endless rope, which can be worked many ways, either by hand, or horse, or steam. I think if the carriages had anti-friction wheels a much less fall than I have named would suffice, but this is open to correction. Every arrangement that is made for and in the line to Greenwich will answer for the corresponding one to London.

A second mode of constructing a decline railway may be by expending about two-thirds of the fall in the first half mile, then running up and over a rise of (say) 30 feet, which, added to the remaining portion of the fall, will be quite sufficient to carry the carriage home, and up the accline on to the platform, as in the first method.

Or, thirdly, the 130 feet fall might be evenly distributed throughout the whole distance, or to within half a mile of the platform—finishing with an accline on to the platform.

All decline railways may be more or less undulated, provided only that the fall is always of amount enough to cause the carriage to attain sufficient velocity or impetus to surmount the succeeding accline. A railway on this principle might reach from one end of the kingdom to the other, as the declines and acclines may pass over or under cross roads or railways. It may be here observed, however, that the height of a terminus must depend upon the length of the line to be formed, and the geographical position or situation of the two ends or termini of the lines. Thus, after having ascertained, as near as possible, the altitude of the two extremities, then whichever end of the line has the greatest altitude, geographically considered, that end will not require so high a terminus to be built as the contrary end. Take, for instance, the Liverpool and Manchester railway. The Liverpool end of this railway is forty-six feet above the rails at the Manchester end of the line; thereby showing that the rail-line from Liverpool to Manchester could with ease have been made upon the decline principle; though, of course, the Manchester terminus or end of the line running to Liverpool would have had to be made twice that height, viz., 92 feet high, in order to give that line a decline or fall to Liverpool equal to the one from Liverpool to Manchester.

A carriage, in descending a decline, will always acquire sufficient impetus to overcome the succeeding accline, providing the acclivity of the accline is one-third below the summit of the preceding slope.

All the stopping stations on a line should be at, or a little below, the summit of a decline, where the fall should be a little more rapid, so as to give the carriage more momentum on its starting afresh, and that no stoppages may take place anywhere but at or near the summit of a decline.

I have endeavoured to be as explicit as possible; but in the breaking of the

ice to any new mode, it often happens that the poor unhappy wight of a projector has so many obstacles to surmount, however good the principle may be on which his ideas are based, that he is at a loss how to work out his plans, so as to meet the views and the prejudices of others.

If, a year or two ago, the public had been told that a carriage and passenger, whose united weight exceeded three hundred pounds, could descend a decline and mount up round a circle, with the car and passengers' heads downward, and so on up an opposite accline, without the least injury or danger to either, they would have laughed at the assertion as chimerical and foolish; and so they will, perhaps, at this, as they have done at everything that breaks in upon the dull routine of ordinary practice.

I do confess myself, that short lines, such as the Greenwich, the West London, the Croydon, and many of the short branches from the great lines in the country, present greater facilities for the decline system than the more extended ones. A good and profitable one may be formed between Paddington and the Bank, Camberwell and London Bridge, Hackney and the Bank, and many other places. I say "profitable," because the first outlay on the erection will constitute all the expenditure, save a few current items of no moment.

Another thing may be considered to promote propulsion, viz., that on long lines of decline railway, such as the Birmingham, or even on short lines, manual labour could be substituted for the steam engine, providing there is the least fall, and anti-friction wheels are made use of. For instance, I would have a carriage (in lieu of the ordinary locomotive engine and tender) so constructed, as to accommodate as many men as would be equal to the task; and as I believe rowing is looked upon as the easiest and the most powerful way for a man to put out his strength, I would have these men—say 12 in number—seated in two rows of six each, one row on one side, and one on the opposite side; and each man's oar-lever might be so attached to the working gear of the running wheels as to give the concern a neat and boat-like appearance. The manual power might be applied in any other way that may be deemed proper; but I mention the rowing mode as looking the best, and believing it to be the most powerful.

I think, if the railway projectors who are now about considering and devising new lines, were to club a little money, and have a line formed a mile in length, alongside the West London, at Wormwood Scrubs, (where the atmospheric plan was first tested) to ascertain the real worth of the system I have suggested, they would find that with a decline of 22 degrees, the momentum or impetus is sufficient to overcome an accline of 14 degrees above the plane of the horison.

But even should the old mode be still persisted in, it surely would be better to make railways more upon the decline principle, as by it the present heavy expenditure for locomotive power might be greatly diminished.

The South-Eastern railway could have been formed with very little trouble on the decline principle, as it passes over so much flat country, that six men with ease could have borne a heavy train along at 25 miles the hour, if the carriages had anti-friction wheels, or even without them, as the inclination would be so good.

With these views I take leave of a subject that deserves a better handling than that given to it by one of your oldest readers and subscribers,

JOHN SUTTON.

14, Crown-row, Walworth-road.

P.S.—If any one going down to Brighton would condescend to trip it in a third-class carriage, he would have an opportunity of observing the little locomotive power required to propel the train along after he has passed that unfortunate and ill-adopted rise from New Cross to Anerley, which compels the companies to keep an engine constantly ready at New Cross to assist the train up the accline. Nearly two-thirds the distance down to Brighton the carriages are hard pressing upon each other, on account of the very slight fall there is in some of the distance, and the momentum which the train acquires—thereby proving beyond all doubt the feasibility of the decline system.

CORCORAN'S PATENT IMPROVEMENTS IN THE GRINDING OF WHEAT AND OTHER SUBSTANCES.

[Patentee, Mr. Bryan Corcoran, of Mark-lane. Patent dated, Aug. 25, 1843; Specification enrolled, February 24, 1844.]

The object effected by the improvements which form the subject of this patent, and which are stated to have been

communicated to Mr. Corcoran by a foreign correspondent, is the admission of air between the grinding surfaces of the two stones ordinarily employed in flour mills, whereby both the material to be ground, and the faces of the stones

Fig. 1.

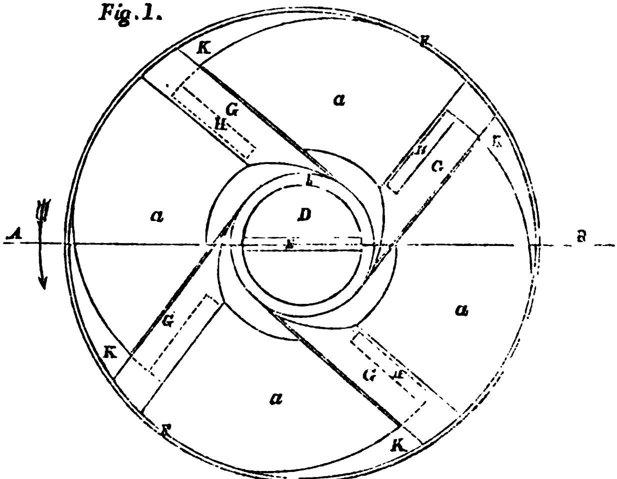


Fig. 3.

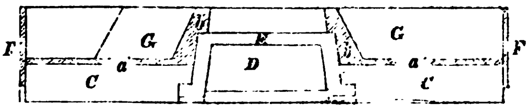
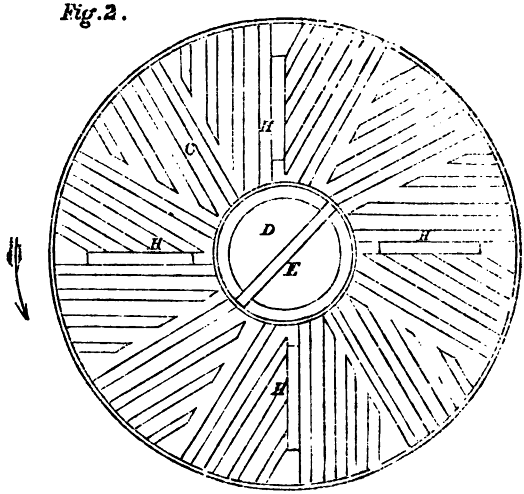


Fig. 2.



themselves may be kept constantly cool. the mode in which this desirable object is accomplished is very ingenious, and will be readily understood from an inspection of the accompanying engravings, and a very few words of explanation.

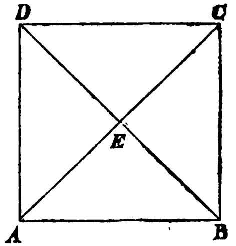
Fig. 1 is a top view of the upper of a pair of millstones; fig. 2 is an under view thereof; and fig. 3 a vertical section on the line A B of fig. 1. C is the millstone, D the eyehole, and E the cross. F is an iron case, which encircles the millstone, and rises above it to the height shown in the vertical section, fig. 3: it is open at top, but has a solid bottom, *a*, which rests on the top of the millstone, and a collar, *b*, by which it is attached to the cross E, so that it may revolve along with the stone. G G G G are four radial vanes, which extend from the collar *b* to the inner circumference of the upper part of the case, and are inclined forwards in the direction in which the millstone revolves. H H H H are four openings made through the bottom, *a*, of the case and the stone beneath, immediately before the vanes G G G G, for the admission of the air between the grinding surfaces. As the stone and case revolve, the air is driven down through these apertures by the resistance it meets with from the vanes. K K K K are guide plates, for the purpose of directing or inclining the air into the openings H H H H.

The inventor declares that he does not restrict himself to any number of vanes or openings in the stones and case, nor to any particular shape to be given to the same; but that these may, consistently with the principle of his invention, be of any convenient number or form.

GEOMETRICAL EXERCISES.

Proposition First.

If two equal straight lines bisect one another, the straight lines which join their extremities will form an equiangular quadrilateral, having its opposite sides equal.

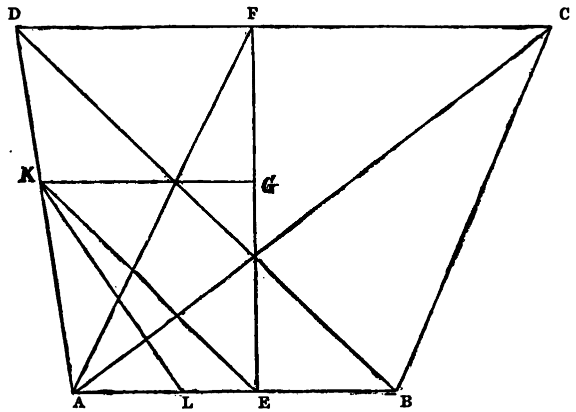


Let the two equal straight lines A C, B D bisect one another in E; join A B, B C, C D, D A; then will the figure A B C D be equiangular, also A B will be equal to D C and A D to B C.

The proof of this only requires the 4th and 15th propositions of the First Book of Euclid.

Proposition Second.

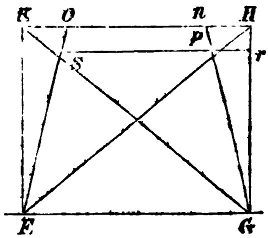
Let A B C D be a quadrilateral, having the angle A B C equal to D A B, and A D equal to B C; but the angle D A B greater than either of the angles A D C or B C D; then will D C be greater than A B.



Steps of the demonstration: Bisect A B, D C in E and F, and join F E, A C, B D; comparing the triangles A B C, A B D, we find A C is equal to B D; and again,

the triangles A D C and B D C, we find the angles A D C equal to B C D. We have also from the triangles A D F, B C F, A F equal to B F, and the angle D F A equal to C F B. Again, from the triangles A E F and B E F, we find the angle A F E equal to B F E and A E F to B E F, and hence each a right angle. So also the angles D F E, C F E are right angles. Bisect E F in G, and draw G K perpendicular to E F, meeting D A in K; join K F, K E; then will the angle F E K be equal to K F E; hence K E A is equal to K F D. Lastly, D C will be greater than A B or D F than A E. For, A E cannot be equal to D F, for then the angle K A E would be equal to K D F, which is contrary to supposition. Nor can A E be greater than D F; for if we cut off E L equal to D E, and join K L, then the angle K L F will be equal to K D F. But the angle K L is greater than K A B, hence K D F is greater than K A E, which is contrary to hypothesis. Therefore, D F is greater than A E, and D C than A B.

Proposition Third.



Construct the right-angled triangle F G H, having the angle F G H a right angle, and the sides F G, G H, equal to the sides A B, B C (Prop. 1,) and upon F H construct the triangle F K H, having the sides K H, K F equal to F G and G H; then the angle F K H is a right angle, and the angle K F G will be equal to K H G, and the two quadrilaterals A B C D, K F G H, will be identical, and each of them rectangular.

If the angle A B C be equal F G H, or D A B equal to K F G, in either case it is manifest the figures A B C D, F G H K, will be identical, and each of them rectangular. But if not, suppose the angle K F G is constant, and D A B, or A B C, &c. variable; suppose also the angles D A B to be acute and less than K F G; make the angle G F O equal to the angle D A B, and let F O meet K H in O, the angle F K O, being a right angle, F O is greater than F K, or A D. Make F S equal to A D, or F K, and make the angle F S r, equal to A D C, or S F G; then F S r, being acute, O S r, is obtuse, and S O H, is also obtuse; therefore S r and O H, cannot meet. Let S r meet G H in r, and make the angle F G P, equal to A B C, meeting S r in P; then by joining S G F P, we prove (4 and 26 Euc. El. 1,) that the figure S F G P, is equal in every respect to A B C D; that is, the figure S F G P will be equiangular, and S P will be equal to F G, and S F, to P G, and the four angles of the figure S F G P are by supposition acute. Join P H; then, because G P is equal to B C, or G H, the angle G P H is equal G H P; hence, the angle G P H is acute, and the more so will G P r be acute; and farther, the angle G P S, or F S P, will be both obtuse, and each greater than S F G, or P F G; therefore, (Prop. 2,) S P is less than F G, and both of these results are inconsistent with the hypothesis assumed. Hence, the angle D A B, or S F G, cannot be acute, and less than K F G, or the angle S F G, that is, F G P less than F G H, that is, less than a right angle.

George Scott.

41, Seymour-place, Montague-square.

THE ATMOSPHERIC RAILWAY—MR. STEPHENSON'S REPORT.

All the world is by this time aware, that Mr. Robert Stephenson has made an elaborate Report on the Atmospheric Railway system, in which, differing from most other engineers who have investigated the subject, he condemns it as utterly unfit for long lines of railway, and only suitable to short lines under very peculiar circumstances. Having at different times published much in its favour, it is due to truth, that we should also record what is said against it by so eminent and competent an authority as Mr. Stephenson. We may hereafter venture to offer some observations of our own on this Report; but in the meanwhile we cannot refrain from bearing our humble testimony, to the great ability and perfect fairness with which it is drawn up. We regret extremely

to observe *the tone* in which it has been commented upon by the patentees of the system, and their patrons and friends. It is not, they may depend upon it, either by affecting an indifference which they are manifestly far from feeling, or by picking out here and there a trivial error of calculation, and vehemently insisting on it as a specimen of the entire production, that such a Report is to be disposed of. It needs, and well deserves the best answer which the best of them can make to it. We have seen several snappish attacks upon it; but as yet not a single endeavour to grapple fairly and manfully with its sum and substance. One word more by way of preliminary observation. The Report of the Committee of the House of Commons, approving of the adoption of the atmospheric system, in the case of the Croydon and Epsom Railway, is triumphantly cited as a conclusive answer to all doubts and objections. Now, the Committee in their Report expressly guard themselves against being supposed to pronounce any judgment on the matter; they put their recommendation solely on the ground of its being a good thing for the public, (as it doubtless is,) to have a further trial of the system made at the expense of private parties, seeing that there are such parties willing to make it.

The Report of Mr. Stephenson is by far too long to be given entire, or even in an abridged state; but the following extracts will put our readers in possession of its principal features.

Economy of the Atmospheric System, as compared with other stationary engine systems.

"Having now, I trust, clearly explained the object and results of the experiments instituted upon the Kingstown and Dalkey Railway, I will proceed to draw a comparison between the working of the atmospheric system, and of other descriptions of motive power which have long been in use, with the view of showing their relative advantages or disadvantages. For this purpose I have selected the stationary engines at Camden Town, because they present a case which is similar to that at Kingstown; or, at all events, the disparities are not such as will materially interfere with the comparison. Table No. VII. represents the gradients and length of the Euston incline, with the weight of the rope there used, the dimensions of the engines, and a description of the various trains that are most commonly drawn up the incline; the total power given out by the stationary engines is then given, and divided into the power absorbed by the resistance of the engines, rope, train, and atmosphere, separately, from which are deduced the proportion of loss arising from this application of the rope as a means of communicating motive power.

TABLE NO. VII.

"The constant upon which this table is founded, an average gradient $\frac{1}{106}$; length worked by rope 0·91 mile; weight of rope 7 tons; area of both cylinders of engine, 2904 square inches, and velocity of pistons 224 feet per minute.

Train.				Horses Power Absorbed by										Power lost by Rope.
Weight.	Friction.	Gravity.	Velocity.	Friction of Engine.	Friction and Gravity of Rope.		Friction and Gravity of Train.		Resistance of Atmosphere.		Train excluding Engine and Rope.	Total excluding Engine.	
Tons	lb.	lb.	Miles per Hour.	H.P.	H.P.	lb. per ton of train.	H.P.	lb. per ton of train.	H.P.	lb. per ton of train.	H.P.	H. P.	Per cent. of total.
35	350	740	20	13	45	24·1	58	31·1	18	7·0	71	116	39
40	400	845	20	13	45	21·1	67	31·1	15	7·0	82	127	36
45	450	951	20	13	45	18·7	75	31·1	17	7·0	92	137	33
50	500	1057	20	13	45	16·8	83	31·1	19	7·0	102	147	30
70	700	1479	20	13	45	12·0	116	31·1	24	6·5	140	185	25
90	900	1902	20	13	45	9·3	149	31·1	29	6·0	178	223	20
110	1100	2324	20	13	45	7·7	183	31·1	32	5·5	215	260	17

" Before I proceed to institute any comparison between the results presented in this Table, and those obtained by the experiments on the Atmospheric Railway, I am anxious fully to explain the data upon which the former are based, and the more so, as all the results are calculated, with the exception of the power absorbed by the friction of the engines, and of the rope. An indicator was applied to the Camden Town engines, to ascertain this amount, and from these results we arrive at the fact that about 58 h. p. is required for working the engines and drawing the rope alone, at a velocity of 20 miles per hour. From experiments upon the friction of the engines and machinery on the Blackwall Railway, where there is the opportunity of disconnecting the rope and drums, and taking the proportions of the power on the two railways, I have considered 13 h. p. of this to be due to the friction of the engines and machinery, which leaves 45 h. p. for the friction of the rope.

"The friction of the several trains taken at 10 lbs. per ton, added to the gravity due to the average gradient, is multiplied into the velocity previously mentioned of 20 miles per hour, and expressed in horses power in the Table. The power absorbed by the resistance of the atmosphere is calculated from the experiments of Lardner, previously referred to. The total power given out by the engines is thus obtained, from which is deducted the power required to overcome the friction of the engines and machinery, for the purpose of making a more correct comparison with the power expended on the Atmospheric Railway at Kingstown, as in that case the power required for this purpose is also omitted. The power required to work the rope in the cases specified amounts to a loss varying from 39 to 17 per cent. of the total, decreasing as the weight of the train is augmented.

" In proceeding to compare with these the results of the experiments on the Atmospheric Railway, it is my object to select a case in each, which shall present the closest analogy in the amount of their resistance and velocity. The 4th train in Table No. VII., and the 18th in Table No. VI., correspond very closely in these particulars, the total resistance of the former, including the friction, gravity, and resistance of atmosphere, being equal to 102 h. p., and of the latter 100 h. p., and the respective velocities being 20 and 18 miles per hour. The loss of power from the working of the rope in the former case is equal to 30 per cent. of the total, while the loss in the latter, arising from raising the vacuum, leakage, and imperfections of the apparatus, amounts to 74 per cent. of the total power. In order, however, to institute a correct comparison between these two cases, the total power in the former must be increased in the proportion of the mean to the maximum velocity, which in this instance is ascertained, from experiments made, to add 37 h. p. to the total, and the comparison stands thus: the loss of power on the Euston incline amounts to 45 per cent., while that on the Kingstown and Dalkey Railway is 74 per cent. This result is obtained with a train which represents the average working of the Euston incline; it is therefore evident that in this particular instance the rope is very considerably more economical than the atmospheric system. If we assume other weights of train, we shall perceive, that as they become lighter, the proportion of loss by the atmospheric apparatus will be diminished on account of the reduction in the effect of leakage accompanying the reduction in pressure, but the proportion of loss by the rope will be increased as the power required to work the rope itself is the same with a light as with a heavy train; while on the other hand, with heavier trains the proportion of loss by the rope will be diminished, and that by the atmospheric system greatly augmented, from the increased effect of the leakage, and the additional power required to raise the vacuum to a greater height.

" This comparison may be carried further by examining the quantity of fuel consumed per day on these two lines; and this I am enabled to accomplish from the observation of a fortnight's working of the Euston incline, and from an experiment on the Kingstown and Dalkey Railway, in which the number of trains, the exact weight of each, and the consumption of fuel, was ascertained during an entire day. The result of the former was, that 13 trains averaging 44 tons each, the mean resistance of which amounted to 1590lbs., were drawn up the incline of 0·91 mile length, at a mean velocity of about 17 miles per hour, in one day of 15 hours, with a consumption of 30 cwt. of coal; and the result of the latter was that ten trains averaging 44 tons each, the mean resistance of which amounted to 1295 lbs., were drawn up the incline of 1·22 mile length, at a mean velocity of about 14 miles per hour, in one day of eight hours, with a consumption of 29 cwt. of coal. The consumption of coal per mile of the trains in these two cases amounts to 284 lbs. on the Euston incline, and 266 lbs. at Kingstown; and dividing these by their respective amounts of friction and gravity, we obtain the comparative consumption per lb. of tractive force as ·18 lbs. in the former case, and ·21 lbs. in the latter.

"The result of this comparison corresponds very closely with the previous com-

parison of h. p. and the slight inconsistency is accounted for by the circumstance that I have not taken into consideration the times the fires were alight, the different construction of the engines, &c. But these I have purposely omitted, as it was not my object to enter into a comparison of details, but only to illustrate generally the main features of the working of the two systems; and this cannot fail to be interesting, inasmuch as it is an instance which allows of a fair parallel being drawn between the two systems of motive power, the amount of work performed in the two cases being nearly alike, and the trains in each being drawn only in one direction, descending in the other direction by the force of gravity. If, however, we take some of the trains which are drawn up the Euston incline, amounting to fully 100 tons weight, we shall find that the total resistance exceeds the capacity of the tube which is employed at Kingstown, namely, 15 inches diameter; for supposing the pressure to be equal to 22 inches height of the barometer, or 11 lbs. per square inch, the train just named upon the gradient of 1 in 75, which is near the upper end of the Euston incline, and continued for about one-third of its length, would offer a resistance, at a velocity of 17 miles per hour, of about 4500 lbs, and would therefore require a tube of 23 inches diameter.

"Such an increase of tube, it must be observed, immediately implied a great reduction of velocity with the atmospheric system, or an increased size of air pump, involving a corresponding increase of power, because the ratio between the areas of the air pump and vacuum tube is affected; and it has been clearly shown that, working at a high vacuum in a small tube, or increasing the size of the tube and lowering the vacuum, if the same amount of power be employed, involves equally the sacrifice of velocity. Here we perceive a decided proof, that what is termed good gradients is not a matter of indifference to the atmospheric system, and that we shall not be justified in attributing to it the power of economizing the construction of railways to any considerable extent by avoiding the necessity of levelling the face of the country.

"By the comparisons we have entered into, we see, that in the case of the Euston incline, a rope is considerably more economical as a means of conveying motive power than a vacuum tube; but if the incline were increased to a length of 3 or 4 miles, this would become very questionable, as the loss of power from the friction of the rope increases exactly in the proportion of the length; but in the atmospheric system the loss from the leakage does not increase so rapidly, as a large portion of it arises from the air pump and tube piston, and is the same with all lengths of tube."

Comparative cost of traction by locomotive engines, and by stationary engines on the atmospheric system.

"I will now proceed to inquire whether the capacity of the locomotive engine and the loss of power by the locomotive system exceed or fall short of that indicated by the experiments upon which this Report is based. The 4th Train in Table No. III. being that in which the greatest velocity was attained, it is taken as the most advantageous to the new system under discussion: the load in this case was 26·5 tons, and the velocity 34·7 miles per hour was attained on a rise of 1 in 115, presenting a resistance of 1311 lbs., including the friction, gravity, and resistance of the atmosphere. In overcoming this resistance, the experiment shows a loss by the atmospheric system of 53 per cent. Now a locomotive engine under these circumstances, in addition to the 1311 lbs., must overcome the friction, gravity, and atmospheric resistance of the engine and tender, which is about 900 lbs., together with a further resistance arising from the pressure of the atmosphere against the pistons, peculiar to the working of a locomotive, as it is a non-condensing engine: these will amount to 32 and 22 per cent. respectively, or together to 54 per cent. of the total power developed by the engine. In this comparison, I have neglected the friction of the working gear of the engine, as this is also omitted in the stationary engine, the indicator diagrams at Kingstown being taken from the air pump and not from the steam cylinder. I have also not noticed the loss that would arise from the slipping of the wheels, when a locomotive engine is worked upon so steep a gradient. The loss of power, therefore, by the use of the locomotive engine under such circumstances, appears somewhat to exceed that shown by the atmospheric system; this is, however, a most disadvantageous comparison for the locomotive engine, because the gradient far exceeds that upon which it can be worked economically.

"When the load is augmented, the loss by the locomotive engine is slightly decreased, and the per centage lost of the total power is therefore diminished; while with the atmospheric system, the per centage of loss is considerably increased, amounting to 77 per cent. with a train of 64·7 tons. These considerations show that with small trains the expenditure of power by the atmospheric system is less than by locomotive engines on this gradient of 1 in 115; whilst on the other hand, whenever the resistance of the

train is such that a high vacuum is required, the locomotive has the advantage over the atmospheric system.

"The lightest trains taken upon the Kingstown and Dalkey incline at the velocities recorded probably exceed the capabilities of locomotive engines, and so far prove that the atmospheric system is capable of being applied to somewhat steeper gradients, and that on such gradients a greater speed may be maintained than with locomotive engines. It must be observed, however, that this advantage is not peculiar to the atmospheric system, but necessarily accompanies every system consisting of a series of stationary engines, in which the gravity of the moving power forms no part of the resistance to motion.

"If we convert the loads moved in the experiments into equivalent loads on a level, we shall then find that in no case they exceed the duty which is being daily performed by locomotive engines. Thus, taking experiment No. 4, the load being 26·5 tons, the resistance per ton upon an incline of 1 in 115, at a velocity of 34·7 miles per hour, estimating the resistance of the atmosphere according to Lardner's experiments previously referred to, will stand thus:—

Gravity	. 20 lbs. per ton.	
Friction	. 10	
Atmosphere	. 20	
	—	
Total resistance	. 50	

And the resistance upon a level will be,

Friction	. 10 lbs. per ton.	
Atmosphere	. 20	,,
	—	
Total resistance	. 30	

Therefore, this train of 26·5 tons, on the incline of 1 in 115, will be equivalent to 44 tons upon a level, at the same speed of 34·7 miles per hour. This duty, which is indisputably the utmost given by the experiments at Kingstown, is much exceeded daily on many lines of railway in this country, and especially by the Great Western, and Northern and Eastern. Throughout the experiments, it will be seen that the duty performed by the Kingstown and Dalkey engine, when reduced to an equivalent level, falls short of the daily performance of locomotive engines on our principal lines of railway, both as regards speed and load.

"When the comparison is made by applying the locomotive engine to the circumstances of the Kingstown and Dalkey incline, the atmospheric system becomes the more advantageous. Such a comparison, however, cannot be held as strictly correct, because the locomotive engine, as a motive power on steep gradients, is wasteful, expensive, and uncertain; therefore, on a long series of bad gradients, extending over several miles, where the kind of traffic is such that it is essential to avoid intermediate stoppages, the atmospheric system would be the more expedient. If, however, intermediate stoppages are not objectionable, as is the case in the conveyance of heavy goods and mineral trains on the railways in the neighbourhood of Newcastle-upon-Tyne, the application of the rope is preferable to the atmospheric system. This conclusion I conceive to be fully established by the comparison which has been made between the Kingstown and Euston inclines. Again, on lines of railway where moderate gradients are attainable at a reasonable expense, the locomotive engine is decidedly superior, both as regards power and speed, to any results developed or likely to be developed by the atmospheric system.

The question of expense of construction.

"In approaching this question, it is desirable first to ascertain how far it may be practicable to work with a single line of vacuum tube, which is certainly by some considered feasible even on great public railways. It does not, however, require much consideration to prove that a single line of tube would be quite inadequate to accommodate any ordinary traffic, such as exists on the principal lines in this country. It has therefore been urged by those who regard the capacity of the atmospheric system as almost unlimited, that a train may be dispatched every half hour, or even every quarter of an hour; but in making this observation, they entirely overlook the circumstance that this very advantage, in respect of the number of trains, is fatal to the sufficiency of one line of tube for any considerable length of railway.

"Suppose, for example, a line of railway for 112 miles length were divided into stages of 3½ miles each, as proposed by the inventors; if a train were dispatched from each end every half hour for 12 hours, and the speed of about 37 miles per hour, including the stoppages for traffic, could be attained, there would be a train at every 10 miles of line, and each train in its journey would meet eleven other trains with whose progress it would interfere; in short, each train would of necessity be stopped eleven times, and delayed until the train occupying the section of the tube had quitted it, and the tube had been again exhausted. Such a series of stoppages would, it is plain, give rise to so great an amount of delay, as would render the use of a double line of tube absolutely imperative. In the example just brought forward by way of illustration, the mean speed assumed is 37 miles per hour, the whole time of the journey would therefore

be three hours; but the eleven stoppages, occupying at least ten minutes each, which is very considerably below what practice would require, would, notwithstanding the great velocity assumed, extend the time to five hours. But let it be remembered that these stoppages cause additional meeting of trains, involving increased delay, and the time is consequently augmented to seven and a half hours. Or if the mean velocity be reduced to 30 miles per hour, which is now the greatest mean rate on any railway, the total time of the journey will be thus increased to 10 hours.

"We must therefore assume a double line of pipe, and thus the principal difficulty just pointed out is certainly removed; but the addition of a double line involves another scarcely less formidable, when the expense of the system is the subject under discussion. The absolute stoppage of trains is avoided, but a most decided and large reduction of speed must still necessarily arise at the stations where the trains intersect, unless a separate series of stationary engines be erected for each line of tube; because the engine must be occupied in exhausting 7 miles of tube at once, which would detract very considerably from the velocity. Such a reduction is quite inadmissible if we are to view the system as applied to the great thoroughfares of this country; in which case I am confident that every perfection of which it is susceptible must be carried out.

"The difficulty suggested as calling for duplicate series of stationary engines, may at first sight appear surmountable by confining the duplication to the points where the trains meet, and thereby avoiding a large addition to the original outlay in establishing the system upon a long line of railway; this, however, presupposes that the trains are not started so frequently as every half hour, since that would occasion the duplication of every engine. But this will not be found to be the case, because the intersections of the trains cannot possibly be made to take place always at the same points, even on the supposition that each railway is worked independently of every other with which it may be in connexion. When we introduce in addition the fact that several branch lines must necessarily flow into the main trunks, that no line can be worked independently, that the arrival of trains is, and must always be, subject to much irregularity, sometimes arising from their local arrangements, sometimes from weather, and at others from contingencies inseparable from so complicated a machine as a railway,—it must be palpable that two independent series of stationary engines are as indispensable as two independent lines of vacuum tube for the accomplishment of that certainty, regularity, and dispatch, which already characterise ordinary railway operations.

"If what has been urged be thought inconclusive with reference to the duplicate series of stationary engines, the alternative of checking or stopping each train at the points where they meet must be admitted as inevitable, because two lengths or sections of the tube must be under the process of exhaustion at one time by the same engine; we have, therefore, to inquire into the practicability of exhausting 7 miles of tube by the engine erected and calculated as only adequate to the efficient exhaustion of 3½ miles length. The calculations made in the previous part of this Report, on the subject of leakage, prove that any attempt to work a line in this manner, would involve such a diminution of velocity at each intersection of trains as could not fail to extend its influence, and produce great irregularity throughout the system when confined even to one independent line of railway; and this would apply, in an exaggerated degree, to the numerous tributary streams of traffic which must flow sooner or later into all the main thoroughfares of railway communication, at points, and under conditions, which cannot at this moment be anticipated. Another very strong reason for these double engines being required is, that in case of any failure to one of the engines, the whole traffic of an entire district of country would be stopped, and a duplicate engine at each station would be required to provide against this contingency, were it not also rendered necessary by the reasons already considered.

"These facts in reference to the expense of construction (for I regard them in no other light than as facts, because they are the inevitable consequences which must attach themselves to this system wherever applied,) lead me to estimate the original cost much higher than any amount which has been calculated upon by those who have made their opinions public on this subject.

"Mr. Samuda gave Sir Frederick Smith and Professor Barlow a calculation of cost, for average loads of 30 tons at the rate of 30 miles per hour, for a single line of atmospheric railway. Since Mr. Samuda furnished this calculation, experience at Kingstown has produced some modification in the proportions of the engines and vacuum tube: the following is now his estimate of cost for the apparatus as applicable to such lines of railway as the London and Birmingham.

Cost per Mile in Length.

Vacuum tube, 15 inches diameter ..	£1,632
Longitudinal valve, &c.	770

Composition for lining and valve groove		250
Planing, drilling, &c.		295
Laying, jointing, &c.		295
Station valve and piston apparatus		100
		3,342
Engine 100 horse-power with pump, &c.	£4,250	
Engine-house, chimney, &c.	450	
Total for 3½ miles	£4,700	
Cost per mile in length		1,343
Total cost per mile		£4,685

"It will be observed that Mr. Samuda has only estimated for a single line of vacuum tube and a single series of engines, under the impression that such an arrangement is adequate to meet every necessity. But from what has been said on this part of the subject, I think it is made evident, that such a limitation in the arrangements on any important line of communication would be very inexpedient, to say the least. I have consequently revised this estimate, and the following appears to me to be the minimum expense at which the atmospheric apparatus could be applied to any extensive line of railway.

Cost per Mile in Length.

Vacuum tube 15 inches diameter		£7,000
2 engines of 250 h. p. each, (at 33,000 lbs.) with pumps, &c., complete, at £25 per h. p.*	£12,500	
Engine-house, chimney, reservoir or well	1,500	
Total for 3½ miles	£14,000	
Cost per mile in length		4,000
Total cost per mile		£11,000

"This amount exceeds Mr. Samuda's estimate very considerably, but the cause has been sufficiently explained: I will merely now add that this branch of the enquiry has been entered upon and pursued with the most anxious desire to under rather than over estimate the cost, and that I am convinced the amounts now put down are below those which would be found in practice. This is undoubtedly the fact, for it will be seen I have taken the size of vacuum tube which was proposed by Mr. Samuda, who I think does not appear sufficiently to have appreciated the importance of fully providing for the large amount of traffic which oftentimes flows simultaneously into a trunk line; which will be understood by those who are well acquainted with the traffic of the London and Birmingham Railway, where it is not unfrequently the case, that on the arrival of the Irish Mail Packet, the train is augmented to twenty and sometimes thirty carriages, equal in weight to 90 or 130 tons, which could not, with due regard to the convenience of the public be divided, and started at such intervals, as would of necessity be the consequence of working with this size of tube. It must also be borne in mind that the present traffic consists of a mixture of quick passenger trains with slow goods trains; and upon the atmospheric system, the latter, which are very heavy, sometimes amounting to 250 tons, must be divided into several trains, not only to bring them within the capacity of the tube, but also to prevent their interference wirh the lighter passenger trains: this it will be necessary to consider when the cost of working is discussed.

"The power of the engines, that I have assumed, may at first appear large, but taking the engine on the Kingstown and Dalkey Railway as our guide, it will be found that the power reckoned upon does not exceed that which would be required to ensure sufficiently high velocities, with only the average passenger trains which now travel on the London and Birmingham Railway; and we must bear in mind, that the atmospheric system involves the necessity of employing very nearly the same power with light as with heavy trains. The maximum power must therefore be regarded as continually in operation: this is not strictly true, but the difference of power of working the air pump at low and high vacuums within the ordinary practical range, is confined to such narrow limits as to render this statement substantially correct. The engine at Kingstown may be taken at nearly 200 horses' power, and capable of moving a train of about 36 tons upon a gradient of 16 feet per mile at 35 miles per hour. If we extend the length of tube to 3½ miles, when the increased leakage is added, the power required to move even such a load, which is below the average load of the London and Birmingham traffic, at this velocity, will exceed the 250 horses' power, which I have assumed as requisite, and which makes the gross expense £11,000 per mile.

"By referring to the half-yearly statements of accounts of the London and Birmingham Railway Company, it will be seen that the capital invested in locomotive engines up to 31st December, 1843, was 171,974*l.* 17*s.* 6*d.* For the purpose of arriving at the whole capital actually invested under the head of

* The power of each of these engines appears at first very great when compared with that given in Mr. Samuda's estimate, but the real comparison upon the same standard of commercial h. p. will be 125 to 100.

power, we must add locomotive engine stations for repairing, &c.; this item is not separately stated in the accounts, but we shall be safe in taking it at 150,000*l.*, making the total investment for power 321,974*l.*

"It must be understood that I am not attempting here to comprise all the sums which might come under this heading, supposing the accounts to be fully dissected; my only object is to make a comparative estimate, which is done correctly enough without introducing such items as would be common to both systems. The comparison of capital expenditure for power upon this basis, on the London and Birmingham Railway, would stand thus:—

Locomotive engines and stations	£321,974
Atmospheric apparatus for 111 miles, at 11,000*l.* per mile..	1,221,000

Making a difference in favour of the locomotive system, as far as capital in power is concerned, of 899,026*l.* This large disparity in the cost of the two descriptions of power, might, it is urged, be more than saved by a reduction in the original cost of construction of the railway. This is partially true in the case of the London and Birmingham Railway, but not by any means to the extent generally imagined.

"I cannot now attempt to enter into the minutiæ of this part of the subject, because it would involve a complete revision of all the original plans, and numerous considerations which could not now be fairly weighed. For the purpose, however, of carrying out the comparison regarding capital in this particular case, we may suppose that a saving of 900,000*l.* might have been accomplished in the original design, by the application of the atmospheric system; still it would only have been a transfer of expenditure from excavations, tunnels, and bridges, to steam engines and pipes. The ultimate capital would thus have been the same.

"If we now take some other lines of railway with the view of ascertaining how far their cost could have been diminished by the application of the atmospheric system, we shall find, that, as the surface of the country becomes more favourable, the economy in construction entirely disappears; and when we arrive at a perfectly plain country, such as exists in the eastern counties of England, where few provisions are required in the form of excavations, tunnels, and bridges, the application of the atmospheric system would certainly double the original cost where a double line of rails is employed. The Grand Junction Railway is a case where no reduction of original outlay could have been effected, since the gradients already conform to the natural surface of the country throughout a very large proportion of the whole line. The adoption of the atmospheric system in this case would therefore have caused a very large augmentation in the capital of the company; probably as much as 8000*l.* per mile, being the difference of cost between the two descriptions of power."

Comparative Cost of Working the London and Birmingham Railway on the locomotive and atmospheric systems.

"The expense of locomotive power upon the London and Birmingham Railway, for the year 1843, was as follows:—

Wages of engine drivers and firemen	£9,673
Coke	25,541
Oil, hose pipes, and fire tools, pumping engines, and water	4,099
Labourers and cleaners, waste and oil	4,194
Repairs of engines and tenders....	12,521
Coals and firewood, expenses of stationary engine at Wolverton, repairs of buildings, gas, and incidental charges................	3,172
Superintendent, clerks' and foremen's salaries, and office charges	4,634
	£63,834

"The expense of working the atmospheric system for one year, I estimate approximately as follows:—

Wages of engine men, 64 at 6*s.* / ,, stokers 64 at 3*s.*	£10,512
The same during the night........	10,512
Coal, 172 tons per day at 9*s*.......	28,332
Oil, hemp, tallow, and repairs at 5 per cent. on cost of engines	20,000
Superintendence same as locomotive	4,634
Annual cost	£73,990

"The above sum has no pretension to precise accuracy, but since I have intentionally omitted numerous items of expense which must arise, (the exact amount of which no one can venture to predict, or to introduce into such a calculation with much confidence,) I prefer making the comparison under that aspect which is the most favourable to the new invention under discussion; because I conceive the question between the atmospheric and locomotive systems does not by any means, after what has been advanced, depend on the mere annual cost of working. I shall content myself with the above statement, which in my opinion sufficiently establishes the fact, that the cost of working the London and Birmingham Railway, or any other line with a similar traffic, by the atmospheric system, would greatly exceed that by locomotive engines."

General Conclusions.

"1st. That the atmospheric system is not an economical mode of transmitting power,

and inferior in this respect both to locomotive engines and stationary engines with ropes.

"2nd. That it is not calculated practically to acquire and maintain higher velocities than are comprised in the present working of locomotive engines.

"3rd. That it would not, in the majority of instances, produce economy in the original construction of railways, and in many would most materially augment their cost.

"4th. That on some short railways, where the traffic is large, admitting of trains of moderate weight but requiring high velocities and frequent departures, and where the face of the country is such as to preclude the use of gradients suitable for locomotive engines, the atmospheric system would prove the most eligible.

"5th. That on short lines of railways, say four or five miles in length, in the vicinity of large towns, where frequent and rapid communication is required between the termini alone, the atmospheric system might be advantageously applied.

"6th. That on short lines, such as the Blackwall Railway, where the traffic is chiefly derived from intermediate points, requiring frequent stoppages between the termini, the atmospheric system is inapplicable; being much inferior to the plan of disconnecting the carriages from a rope, for the accommodation of the intermediate traffic.

"7th. That on long lines of railway the requisites of a large traffic cannot be attained by so inflexible a system as the atmospheric, in which the efficient operation of the whole depends so completely on the perfect performance of each individual section of the machinery."

CONTRIBUTION TO THE HISTORY OF GAS LIGHTING. BY MR. JOHN HART.

[A paper on coal-gas, by Dr. Thomas Thomson, having been lately read before the Glasgow Philosophical Society, it was followed by a discussion, in the course of which the following interesting statement was made by Mr Hart. We quote the report of it given in the *Glasgow Mechanics' Magazine*.—ED. M. M.]

Having heard that Lord Dundonald used gas from coal, as a light, long before Mr. Murdoch's discovery, and being in Culross Abbey, while it was unroofed, and in a state of ruin, I naturally began to examine the walls, to see if I could discover any trace of the pipes, when Sir Robert Preston's gardener informed me, that he believed no pipes were used, as some of the old people of Culross, who saw it, told him that the gas was carried in a vessel from the tar works and burned in the Abbey.

I afterwards discovered that an intelligent old man, a blacksmith, in our neighbourhood, had been long in the employment of his lordship, and that he had been his assistant in many of his experiments about that period. From him I received the following account:—His lordship having been in company with some scientific friends, on the following morning he mentioned to his blacksmith that on the previous night he had been shown a work* which gave an account of a process for distilling pit coal, and from which a substance like tar might be obtained in considerable quantities. This he wished to try, as he thought it might be made to serve the purposes of common tar; and he then told him to come along with him to the garden, where he pointed out a spot, and gave him instructions to set about the erection of an oven or kiln to try it; the experiment succeeding, nothing more was done until it was secured by a patent. Soon after, nine cylindrical ovens of brick were built in a row, along a bank of earth; these were about 3 feet in width, and about 7 feet deep, being hemispherical at top and bottom, each having a moveable cover at top, for charging, and a well-fitted door at bottom, to regulate the combustion; a 7 inch cast-iron pipe near the top conveyed the products to the condenser, on the top of the bank. The condenser was a flat box of lead, having divisions partly crossing it, to detain the vapours of the tar, and very much resembled the coolers used by brewers, from having a rim to retain cold water on its upper surface, with which it was plentifully supplied. The tar was conducted by a pipe into similar cylinders of brick-work, on the opposite side of the bank; each of these had a small opening in the top, for the escape of the incondensible part of the products. To these openings the workmen were in the habit of attaching a cast-iron pipe, by means of a lump of soft clay, and lighting the gas at the other end, to give them light during the darkness. His lordship, also, was in the habit of burning the gas in the Abbey as a curiosity; and for this purpose, he had a vessel constructed resembling a large tea urn; this he frequently caused to be filled and carried up to the Abbey, to light the hall with, especially when he had company with him. On one occasion, after a fresh charge, the workmen having applied his light too soon, an explosion took place, which nearly killed some of the men, and tore off the top of the condenser; and one

* This might, probably, be Dr. Richard Watson's Chemical Essays, published in 1787—in which he details experiments he made on the distillation of pit coal; and also, the quantities of coke and tar obtained from the various kinds of coal.

of the workmen's wives, passing near it at the time, was blown off the bank; fortunately, she fell over, into her husband's lap, (who happened to be sitting below at his breakfast), without receiving any other injury than the fright. However, after this accident, the men became very cautious in applying a light to the pipe until the whole of the atmospheric air was displaced. In giving this statement, I do not mean to detract, in the smallest degree, from the merits of Mr. Murdoch, as it appears this gentleman knew nothing of what was going on at Culross. All I wish to show is, the state of knowledge, on this subject, in Scotland, ten or twelve years prior to Mr. Murdoch's discoveries. As Lord Dundonald's object was the manufacture of tar, his researches would, probably, be confined to the quantity of tar, and not to the quality of the gas, and as his gas from the tar-kilns must have been very inferior—being from common coal, and also partly mixed with the air after combustion, in the kilns, the light must have been inferior to candles. But even, although he had observed the high illuminating power of gas, from cannel-coal, the high price of cast-iron pipes, and the little use they were put to, especially in Scotland, at that period, must have rendered such an idea, if it had ever occurred to him, or even to Dr. Clayton, as a thing perfectly impracticable. It required a more extensive knowledge and experience in engineering than any of those gentlemen were possessed of, to entertain, for a moment, the practicability of such a scheme; even Mr. Murdoch and his friends at Soho seem to have had their doubts about the possibility of raising funds sufficient for such a gigantic undertaking as the lighting of a city, if we may judge from the little interest they took in it, even after lighting up the cotton-factory of Messrs. Lee and Co., of Manchester.

Shortly after fitting up the little gas apparatus, described in Robertson Buchanan's Treatise on Heat, as we could not procure cannel coal, at that time, in Glasgow, we were obliged to make our gas from common coal, the flame from which being very grey, I thought it might be possible to improve it, or to make the gas take up an additional dose of carbon, by making it pass over charcoal of wood, at a strong red heat, previous to its entering the condenser, and that I might also produce a greater quantity of gas by more effectually decomposing the tar. For this purpose I procured a one-and-a-half inch cast-iron pipe, and having charged it with charcoal, I passed it through the furnace below the retort, and joined one end with the pipe from the retort, and the other end to the pipe leading to the condenser, the fire was then applied, and the retort charged as usual. After the gas-holder had risen about a foot, we observed the pipe leading to the condenser (which was of lead) becoming very hot. It soon after gave way, and fell to pieces, and the whole of the gas escaped into the air; but it had no longer the yellow silky appearance of gas issuing from a retort; it had become a white vapour, and had also lost the smell. As we could not collect any more of the gas, we withdrew the fire, and allowed the whole to cool down. When I took out the charcoal to examine it, in place of its being acted upon by the gas, as I supposed, I found it covered all over with a beautiful smooth shining black coat of carbon, which had been deposited upon it. This was extremely brittle, and started off, like scales of iodine, when pressed upon by the nails. As the gas was mixed with part of a former charge, we could not ascertain its quality—but it certainly did not seem at all improved; indeed, the gas seemed rather to have parted with a portion of its carbon, (by passing through the red hot charcoal,) than to have acquired an additional dose. On this account I did not prosecute the experiment further. However, this deposition of carbon, in the solid form, upon the charcoal, led me to examine, more minutely, the appearance of similar shining depositions upon pieces of common coke, and also the deposits of carbon that were formed both within and below the retorts of the Glasgow gas work. The change, too, that was produced upon the flame of a piece of coal, in an open fire, arrested my attention also. I observed that when it passes up through a mass of glowing cinders, it loses its brightness, and becomes a dusky yellowish-red colour, like common hydrogen, just as if the carbon had been abstracted from the hydrogen, in its passage through the cinders; and, therefore, when I saw the report drawn up by Dr. Henry, of the analysis of the gas obtained by him during different periods of the charge, from the same retort, this deterioration of the gas in the latter period of the charge appeared to me to proceed rather from the deposition of the carbon held in solution by the gas, in coming in contact with the new-formed coke, in the exterior part of the charge, than from an inferior gas being given off from the coal in the centre of the retort, any more than from that part of the coal which was in contact with the retort itself. And therefore, to obtain gas of nearly as uniform a quality as possible from the whole of the charge, a change ought to be made upon the present form of retorts, so as not only to apply the

coal in a thin layer to the surface of the retort, (as had already been pointed out by Mr. Maben, of Perth,) but also to protect the gas from the action of the incandescent carbon when formed.

THE ATMOSPHERIC STEAM-ENGINE.

Sir,—The friends of the late Mr. S. Seaward may fairly claim for him, I apprehend, the arrangement of the atmospheric engine to produce rotative motion by direct action on the crank, by means of a simple, and perhaps the best mode of employing the connecting rod; and the credit due to him is of no mean order. Still Watt's condenser is the principal cause that the atmospheric can be used as a steam-boat engine. "Seaward's arrangement of Watt's atmospheric" would indicate my view of the case.

The introduction by "Curve" of the value of the steam pressure, as one of the elements in the estimate of friction, will soon reconcile any differences of meaning that might be inferred from our expressions.

Perhaps he will reconsider his condition of a "proper system of felting" on the outside of the cylinder as affecting the loss of heat from the inside of the atmospheric engine. The adoption is equally advisable in open or closed cylinders, but it would render the differences, from the total loss of cylinder heat, comparatively greater by effecting an equal saving in both, though of course the positive loss would remain unaltered in the open cylinder.

Concurring in the view, that this is of minor importance, perhaps "extremely light," I had hoped for facts rather than opinions; being aware that it is the practice of theory to enhance rather than, diminish the values of its estimates. Tredgold, for instance, Article 161, old edition, gives the loss from this cause as $\frac{1}{15}$ if water is used for packing the piston, according to former practice; and $\frac{1}{23}$ in other cases. Now a loss of above $6\frac{1}{2}$, or even rather less than $4\frac{1}{2}$ horses power out of a 100 horses power engine is a startling position as to figures—to be best refuted by facts. At present I hold this estimate to be somewhat analogous to that which he gave of the power required to work the air piston.

In my first letter I did not intend, as may be possibly inferred, to limit the use of higher steam in an atmospheric to lifting a heavy piston to act by its return weight. In rotative engines, steam above atmospheric pressure, (8 to 12 lbs., for instance), might be used to drive up the piston against the atmosphere, and act by its excess on the crank in the up-stroke.

There would be a tendency to lessen the irregularity of the pressures—already it seems nearly imperceptible in the *Sapphire;* and the increase of the size of the cylinders for a given power, would be reduced to a minimum as compared with closed cylinder engines.

I remain, yours faithfully,

S.

June 5, 1844.

GENERAL RULE FOR FINDING THE CONDITIONS OF BUOYANCY, OR EQUILIBRIUM OF METAL BALLOONS.

Sir,—Since the subject of metal balloons is in progress of being laid before the world in a practical shape, by M. Monge, of Paris, the following rules may not be devoid of interest, to persons who may be directing their attention to this branch of science. Probably there may be something original, if not useful, in this communication, and should it be fortunate enough to meet with your acceptance, I shall feel greatly obliged by its insertion in the columns of your recreative and useful Magazine.

Suppose a balloon consists of an entire shell of any sort of metal. If, then, the diameter in feet be multiplied by the decimal 0·15, and the product be divided by the number of pounds in a cubic foot of such metal, the quotient will be the thickness of the shell in decimals of an inch of an equilibrium balloon, or one, that if exhausted of air, will be equal in weight to its own bulk of that element,—call it, if you will, the zero of buoyancy.

In giving an example, by way of proof, I assume a diameter of 30 feet (the reported diameter of the French balloon), and sheet copper of the specific gravity of 557·2 lbs. per cubic foot. Then, $\frac{30 \times 0{\cdot}15}{557{\cdot}2} = {\cdot}00807609$, equal the thickness of the shell. Now let the last-found quotient be reduced to the decimal of a foot, by dividing it by 12, then, the weight of metal in the balloon will be,

$3{\cdot}1416 \times 30 \times 30 \times {\cdot}0006730075 \times 557{\cdot}2 =$ $1060{\cdot}289$ lbs. And for the weight of an

equal bulk of air, of the specific gravity of ·075 lbs. per cubic foot, we have $\cdot 5236 \times 30 \times 30 \times 30 \times \cdot 075 = 1060 \cdot 29$ lbs., showing a beautiful equality of results, a satisfactory Q. E. D.

Take an example of the reverse operation. In finding the diameter of a balloon from its given thickness, suppose $\frac{1}{200}$ of an inch (the reported thickness of the French balloon,) then $\frac{557 \cdot 2 \times \cdot 005}{0 \cdot 15} =$ 18·573 feet, equal the diameter of the equilibrium balloon. It will now appear, that the French balloon of the same thickness, and far superior diameter, would seem to possess a considerable ascending power, unless, endeed, it be too much encumbered by strengthening bands, and solder for securing the joints, which must of necessity add greatly to its weight. I hope, however, M. Monge's *hobby* may be found strong enough to carry him.

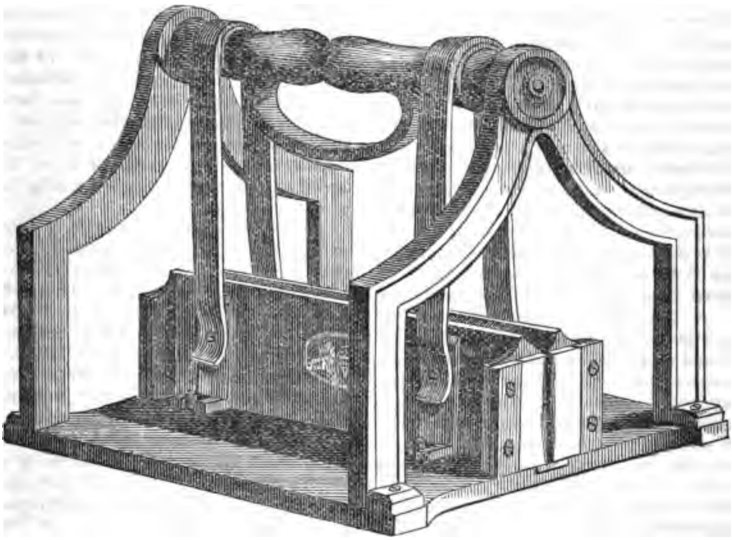
Allow me, in conclusion, to indulge a little in recreations of the fancy, by an application of the rule to the earth's diameter of 7,924 miles; taking this diameter in feet, we obtain $\frac{41838720 \times 0 \cdot 15}{557 \cdot 2} =$ 11263·115578 inches = 938·592 feet, equal the thickness of the shell of copper in this case. By a far more tedious process, however, the true thickness is found to be 938·635 feet, the difference between the results of a concise rule, and a very laborious one, being half an inch only. I will now, Mr. Editor, cut the matter short, lest I should be suspected of an attempt to upset the sublime theory of Newton.

Yours truly,

J. LOOSE.

Wolverton, June 7, 1844.

MADDEN'S KNIFE-CLEANER, POLISHER, AND PRESERVER.



Alas! the march of machinery! Where is it to stop? What things, great or small, can hope to escape its omnivorous swallow? Flails, spinning jennies, handlooms, hoys, four-horse coaches, six-wheeled wagons, all come alike to it; gulped up in an instant, to be heard of no more, perchance, unless fished up by some one desperately curious in antiquities. Behold now even the scullery invaded! The common knife-board superseded by a machine which can clean and polish a whole table service in the same time that it now ordinarily takes to do a single knife. Without any of the dirt or noise too, for which knife-cleaning has from all time been celebrated. Can it be denied

that in this instance, at least, if not in every other, machinery brings with it its advantages and consolations? We fear not.

A view of this machine is given in the prefixed engraving. From the bar which forms the top, and which is held by the left hand to steady the machine, descends two strong bent steel springs, the ends of which are screwed into two curved plates of iron, about fifteen inches long, and two inches wide, which are thus kept in a horizontal position on their edges, and are pressed close together by the action of the springs. These plates are lined with leather, and are bevelled off at the tops, forming a groove, in which is placed a polishing powder which gradually works its way into the leathers. On inserting a knife between them, and moving it backwards and forwards three or four times, it comes out thoroughly cleaned, both sides and back at once.

REPORTS BY THE COMMITTEE ON SCIENCE AND THE ARTS OF THE FRANKLIN INSTITUTE, ON INVENTIONS REFERRED TO THEM FOR EXAMINATION.

[From the Journal of the Franklin Institute.]

Laubach's Blacksmith's Tuyere Iron.

That they have examined the model of Laubach's Patent Tuyere Iron, with a revolving or vibrating hearth.

The improvement consists of a vertical cast-iron cylinder, about 8 or 10 inches in length, and from 4 to 5 inches in diameter, with a concave flanch at the upper end, that corresponds with and forms the bottom of the hearth; this flanch also projects inward, and contracts the opening in the cylinder to about 2 inches diameter; this aperture is regulated by a sort of triangular valve of cast-iron fixed on a rod that passes out in front of the forge, (similar to a throttle valve,) this valve regulates the quantity of blast, and closes the aperture when required, to prevent the small coal, or cinder, from falling into the cylinder, which is provided with a sliding bottom that may be withdrawn when necessary to discharge the coal, or cinder that may have accumulated in the cylinder. There is a horizontal tube projecting from the side of the cylinder to receive the pipe of the bellows.

We believe the arrangement is new. The claim set forth by the inventor, is for constructing the blacksmith's forge with a revolving or vibratory hearth; and, in combination therewith, the cylinder with a basined rim, forming part of the hearth, and having a tube to receive the nozzle of the bellows; said cylinder receiving the blast from the bellows, and serving as a receiver for the small cinder, as before described.

The committee are of opinion that it is superior to any of the former tuyeres that have been brought forward; they are, moreover, strengthened in their opinion by many certificates, which have been given of its superiority by persons who have made a trial of it, and would, therefore, recommend it to the notice of the public.

By order of the Committee,

WILLIAM HAMILTON, Actuary.

Calderhead's Carpet Loom.

That the main features of this invention, are placing the pattern cylinder under the warp, and causing it to act upon perpendicular needles, each of which has an eye through which a thread of the warp is passed, thus enabling each particular thread to be lifted by the pattern, at the proper moment, to produce a shed for the weft to pass through, and form a point in the figure of the fabric in hand.

The committee have not the slightest doubt, that Alexander Calderhead actually invented the improved loom before them, and think he deserves the highest credit for the ingenuity and perseverance with which, through many discouragements, he has laboured to bring his loom to its present state of simplicity and perfection; and the committee will here incidentally observe, that they have good reason to believe that looms upon this simple plan will be found highly useful for weaving carpets, and similar fabrics of a coarse texture.

Nevertheless, an examination of previous patents has brought the committee to the conclusion, that the same form of loom, in all its essentials, has been before devised, and made the subject of a patent, by C. M. H. Molinard, which passed the Great Seal of England on the 9th of April, 1833, (see *Newton's London Journal of Arts, &c.*, vol. xv. conjoined series, page 287,) where the following description will be found:

"The present invention is to place the roller which carries the pierced cards under the warp threads, in the back part of the loom, and to cause the pierced cards as they successively come into operation, to act against the under parts of a series of perpendicular needles through the eyes of which the warp threads are severally passed."

This description precisely applies to the loom before us, which, therefore, cannot be regarded as a new invention.

By order of the Committee,

WILLIAM HAMILTON, Actuary.

JOHNSTON'S PATENT IMPROVEMENTS IN STEAM BOILERS—DESCRIPTION OF A SEVEN-HORSE POWER BOILER, CONSTRUCTED ACCORDING TO MR. JOHNSTON'S PLAN, AT PRESENT WORKING ON BOARD THE "ALERT" STEAMER, AT THE WEST QUAY, GREENOCK. COMMUNICATED BY THE INVENTOR.*

The boiler, properly speaking, consists of two parts, viz., the furnace and the body of the boiler. The furnace is placed on the front and outside of the boiler; the sides and roof of it are made of a double casing of sheet iron, the iron of each casing being one eighth part of an inch thick; the water space between the casings is a quarter of an inch wide, and the casings are bolted to one another every two and half inches.

The sides of the furnace are perpendicular; the roof is sloped like the top of a house, each half of the roof being set at an angle of forty-five degrees to the sides of the furnace. The water space of the furnace has three openings or communications with the body of the boiler; of these communications there is one at the lower part of each side of the furnace, and the third is at the ridge of the roof of the furnace. In consequence of this arrangement, a powerful current of water is constantly circulating up the sides, and over and along the roof of the furnace. It is this current of water which prevents the deposit of salt and other substances.

The body of the boiler is divided into seven chambers or flues, which communicate at one end with the furnace, and at the other end are each provided with a separate chimney communicating with the funnel. Each of these chambers measures, from top to bottom, 2 feet 9 inches; from furnace to chimney, 2 feet; width, 2 inches.

Between each chamber there is a water space of a quarter of an inch in width. In those narrow water spaces, the ascending current of water is created by the action of the heat supplied from the seven chambers. At each side, in the body of the boiler, there is a large water space, through which the currents of water descend, and on those descending water spaces the fire is not allowed to act; for were this permitted, the velocity of the current would be checked, and the boiler injured.

The entrances from the seven chambers into the chimneys are at the bottom or lower part of the chambers. By this arrangement a saving of fuel is effected, as the products of combustion are thus retained in the chambers until all the available heat has been absorbed by the water.

This boiler has been in active operation for eight days, working ten hours each day, with salt water; and so very far from there being the slightest deposit of salt, or any other injurious substance, on the flues of furnace, the currents of water have, on the contrary, worn or displaced the rust which originally covered the plates of which they are formed.

Boilers constructed according to this plan can be made to weigh less per horse power than any other description of boiler at present existing, and this without any diminution of the strength of the boiler.

J. J.

Willow Park, Greenock, 10th June, 1844.

* Mr. Johnston's patent is dated 8th February last; the specification due 8th August, is not yet enrolled.

TOWNEND'S PATENT WATER REPELLENT FABRICS.

[Patentee Charles Townend, of Manchester, Fustian Manufacturer. Patent dated, March 6, 1844; Specification enrolled, May 4, 1844.]

We extract the following description of these fabrics from the patentee's specification:

"My improved process or manufacture whereby cotton fabrics are sided and made repellent to water and mildew, and any unpleasant smell is prevented in such fabrics, consists in steeping the fabric which is intended to be sided and made repellent to water and to be preserved and protected from mildew and any unpleasant smell in the solutions hereinafter described, or in drawing or passing the same fabric through such solutions, which I have found to sid the cloth, and make it repellent to water, and prevent mildew and any unpleasant smell in such fabric or cloth, and since I believe and understand it to be the general practice of dyers and others, accustomed to use such like processes, to mix their solutions, with reference to the manufactured material to be steeped therein, or drawn, or passed through the same; and without regard to its length or width, I shall describe my process on this plan, which is generally taken as the most accurate. The mixture of ingredients which I shall now proceed to describe will be found the best quantity in which to steep, or through which to draw or pass fabrics of about the weight of 40 lbs. for 60 yards in length, and about 27 inches in width of such fabric. The manner in which my said improved process or manufacture is to be performed, is by a mixture or new combination of the following ingredients in the subjoined, or any other relative proportions.

"Take 8 gallons of cold water into a vessel or vat, and add thereto 20 lbs. of calcined British gum, and mix them well together until fine and pasty. Then take 7 gallons of boiling water in another vessel or vat,

and add thereto 10 lbs. of palm or white soap cut into small pieces, and when thoroughly dissolved add this solution to the above gum mixture; then put in one pint of logwood liquor, and boil them up together; then add thereto 3 lbs. of common or rock alum in its crystallized state, and for the purpose of rapid dissolution, I prefer that the alum should be previously ground or pulverized, and well boiled or dissolved in one gallon of water; boil the whole up together for a few minutes, and the mixture will then be ready for use. The cloth or fabric intended to be saturated (having been previously prepared and dyed) is to be introduced into a suitable vessel containing the above mixture, and to be steeped in, or drawn, or passed through the same in the usual manner of stiffening and dry cotton fabrics. It will be found that the cloth which has been submitted to the above process will be entirely divested of any unpleasant smell, and have a non-absorbent property; in fact, be repellent to water, and will also have a preventive finish against mildew; and the colour and feel of the cloth will be much improved. I also wish it to be understood that I have found that the following combinations of solution and of mixture will produce a similar result; viz., for the solution boil 6 lbs. of sulphate of zink (white vitriol) in 9 gallons of water, allow it to go cold and settle, then draw off the clear solution leaving the sediment, then take 8 gallons of cold water, and add to it 20 lbs. of calcined British gum, and mix them well together until fine and pasty; then take 8 gallons of boiling water, and add to it 10 lbs. of palm or white soap cut into small pieces, and when slowly dissolved add to it the last-mentioned gum mixture; add also ½ oz. of pearl-ash, and bring them up to a boiling heat; the mixture is then ready for use. The cloth or fabric intended to be saturated (having been previously prepared and dried in the usual way) is to be first steeped in or drawn or passed through the zink solution and then immediately afterwards steeped in or drawn or passed through the last-mentioned mixture in the usual manner of stiffening and drying cotton fabrics.—Although this invention is principally intended to be used for such goods or fabrics as are manufactured from or with cotton, I wish it to be understood that I chiefly intend to apply the said processes and new combinations to friction cloths commonly called Beaverteens, and I distinctly state that I do not mean to confine my claim to the use of the precise quantities here specified, as they are mentioned merely for illustration, and are such as I have found in practice to be most convenient and beneficial."

NOTES AND NOTICES.

The most Magnificent Organ in the World.——The organ of Fribourg is celebrated throughout Europe; the whole of Switzerland speaks of it with pride. One government has offered the maker 100,000 francs to build one similar to it; but the organist of Fribourg is too old and too great a philosopher to undertake it. His fame and his profits are sufficient to his ambition and his wants. He is always at the disposal of amateurs, and ready to play on his organ for twelve francs. The price is the same whether he plays for a single individual or a number. After dinner, at the Hotel de Sœringham, which is the first in the town, travellers are in the habit of going down to the church, where, by means of a small collection, made among themselves, they hear the most magnificent concert which can be imagined. Nothing can convey an idea of the effect of this beautiful and solemn music heard in the evening, under the dark and melancholy roof of a cathedral. At first are heard the soft sounds of a pastoral scene; anon the thunder growls, the shepherds and their flocks fly, terrified, to seek the shelter of their homes, and the villagers assemble for evening prayer. This last part is the most beautiful and the most astonishing of the whole concert. The organ of Fribourg produces, most astonishingly, the sound and the accent of the human voice. One hears, distinctly, the men, the women, and the children singing, sometimes together, sometimes solo, and every word uttered by the individual is clearly pronounced by this almost miraculous instrument. This is certainly a very great wonder; and the secret of the organist of Fribourg may produce a wonderful change in the whole art of music.—*Jersey News.*

American Scraps.—The Treasury department is now building six iron revenue steamers of 350 tons each, under the direction of Captain Howard; two of them are on Ericsson's plan, and four on Lieutenant Hunter's plan.——Last year, the West had 450 steam-boats of 90,000 tons. It has now not less than 600, with the average tonnage of 125,000 tons, and their value at 72 dols. per ton, is about nine millions of dols.——During the last year. 12,035 tons were built at Cincinnati and 7,400 tons at Louisville.——Mr. J. B. Allen, of Springfield, Conn., has completed a telescope 8 feet, with lenses of a magnifying power of about 1300.——Captain Page is building a steamer of large dimensions, at Bath, Me., for navigating the Black Sea. She is on Ericsson's principle.——Extensive cotton factories are being erected at Cincinnati.——The organ now building in New York, for Trinity Church, is to be 53 feet high, 27 wide, and 32 deep. The whole number of pipes will be 2,169, divided among 43 draw stops, 11 of which are to be diapasons. The largest metal diapason pipe, which will be visible in the centre of the organ's front, is to be 5 feet in circumference, and 28 feet long. The organ is to have 4 key-boards or ranks of keys. Its entire weight is estimated to be more than forty tons. It is to cost 10,000 dollars.——The John Mason, steamer, made the passage from Troy to Albany, 7 miles, in 21 minutes! This is 4 minutes less than any steamer ever made it before.——A locomotive with 31 burden cars, burst on the Roanoke-road, and did considerable damage.——Horse-hair bonnets have appeared in Broadway, New York.——The bucks in Iowa, when dressed in their Sunday go-to-meeting togs, have a pair of pantaloons composed of hemp and hop vines, a vest made of a hornet's nest and paste, a shirt manufactured of mill weed and cotton, and to crown all, they wear wolf-skin caps and go barefoot. What will Mrs. Trollope say now?

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

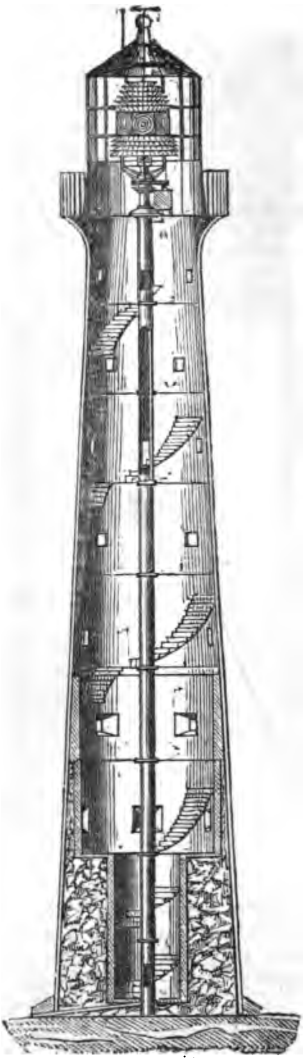
No. 1089.] SATURDAY, JUNE 22, 1844. [Price 3*d*.

Edited by J. C. Robertson, No. 166, Fleet-street.

THE BERMUDA LIGHT-HOUSE.

DESIGNED BY ALEXANDER GORDON, ESQ., C. E., AND CONSTRUCTED BY MESSRS. COTTAM AND CO.

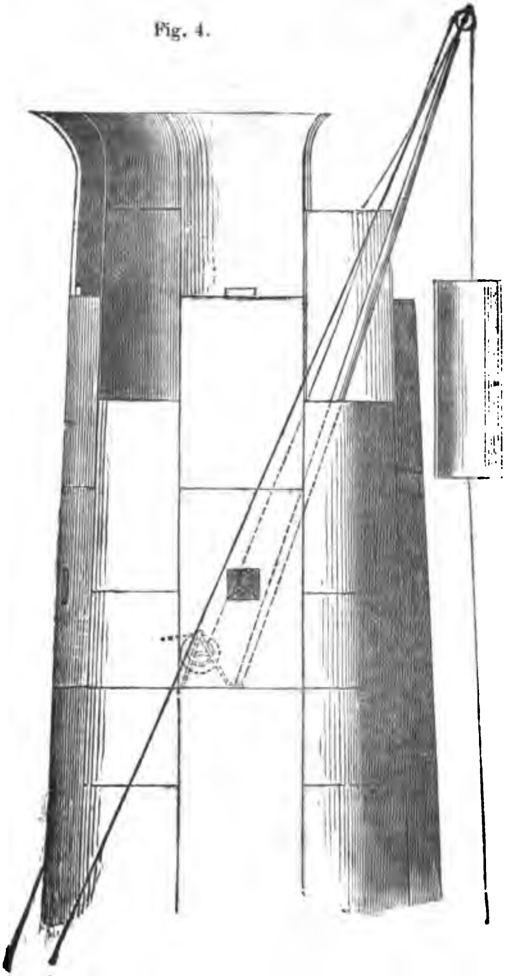
Fig. 1.



THE BERMUDA LIGHT-HOUSE.

We gave in our journal of the 4th May last, a brief description of the iron light-house then erecting, by Messrs. Cottam and Co., under the able superintendence of Mr. Alex. Gordon, C.E., for the Island of Bermuda, and which now in its complete state forms a very striking object among the towers and turrets on the Surrey side of the Thames, opposite to the Adelphi Terrace and Temple Gardens, whence it will in a few weeks be removed and shipped to its

Fig. 4.

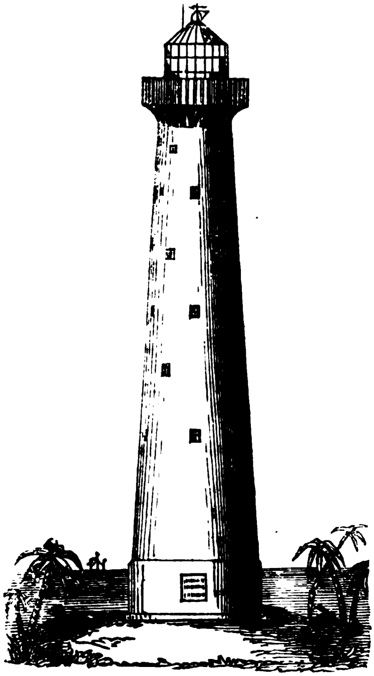


permanent site in the western hemisphere. We are now enabled, through the kindness of Mr. Gordon, to present our readers with the accompanying pictorial illustrations.

Fig. 1 is a sectional elevation of the structure, in the state in which it will be when finally erected on the top of Gibb's Hill—towering to an altitude of 368 feet above the level of the sea; and fig. 2 and 3 are external elevations on a diminished scale, both of this light-house and of that previously erected by Mr. Gordon on Morant Point, Jamaica, showing the difference in height between the two edifices. Fig. 4 represents the manner in which both of these towers have been raised from the inside, without scaffolding.

The Jamaica light-house was first proposed to be of masonry; but the cost of such a structure would have been from 25,000*l.* to 30,000*l.*; it would have taken a long time to erect it; it would have been necessary to send out European workmen for the purpose, many of whom must have perished from the unhealthiness of the climate; and when completed, the first severe earth-

Fig. 2.



quake or thunderstorm might have caused it to share the common fate of all lofty stone structures in tropical regions. The iron tower, which was substituted on the recommendation of Mr. Gordon, did not cost as many hundreds; it was constructed at home, and sent out in parts ready for fitting together, within five months after the order for it was given; within five months more it was erected at Morant Bay, (1st Nov. 1842;) and though it has been since shaken by several earthquakes, and been twice actually struck by lightning, it remains to this day uninjured.

The greater height of the Bermuda light-house, and the more exposed posi-

Fig. 3.

eminence of considerable elevation, and Morant Point is a long low promontory,) has made it necessary to make it of much greater strength; but in this as in all other particulars it is so well planned and executed, that we have no doubt of its giving equal satisfaction with the other. At top there is a lightning rod so fixed that in the event of the tower being struck by the electric fluid, it will lead it off down the sides of the tower, and thus prevent its doing any damage to the valuable lenticulated apparatus within, which is of Fresnel's "first order" of excellence. At bottom the conductor will terminate in four radiating iron chains sunk in the rock which will

ON THE APPLICATION OF SUM AND DIFFERENCE LOGARITHM TABLES.—PART II.

Sir,—It is my intention in the present paper to show how Matthiessen's table is made available for the purposes intimated at the commencement of the previous paper, viz., when the logarithms of two numbers are given, to find the logarithm of either their sum or their difference.

It is to be kept in view, that the relation of the logarithms in the different columns of the table is as follows:—If A, B, and C represent corresponding values in the several columns, and,

$$\text{if } A = \log m,$$

$$\text{then will } B = \log\left(1 + \frac{1}{m}\right),$$

$$\text{and } C = \log(1+m).$$

Problem I. Given $\log a$ and $\log b$, of which $\log a$ is the greater; to find $\log(a+b)$.

Since $\log a$ and $\log b$ are given, $\log\frac{a}{b}$ is also given, being equal to $\log a - \log b$.

Let $\log\frac{a}{b} = A = \log m$, and consequently, passing to numbers, $\frac{a}{b} = m$.

Then will $1 + \frac{1}{m} = 1 + \frac{b}{a} = \frac{a+b}{a}$, and $1 + m = 1 + \frac{a}{b} = \frac{a+b}{b}$. Hence, returning to logarithms,

When $A = \log\frac{a}{b}$, or $\log a - \log b$,

then is $B = \log\frac{a+b}{a} = \log(a+b) - \log a$,

and $C = \log\frac{a+b}{b} = \log(a+b) - \log b$.

From the first of these equations we obtain,

$$\log(a+b) = \log a + B \;.\;.\;.\; (1)$$

and from the 2nd,

$$\log(a+b) = \log b + C \;.\;.\;.\; (2)$$

Hence the following

Rule.—Subtract the less of the two given logarithms from the greater, and seek the difference in column A; then will the corresponding value in B, added to the greater logarithm, or that in C, added to the less, give the logarithm required.

Example 1.* Given $\log a = 2{\cdot}8456042$, and $\log b = 1{\cdot}8068778$, to find $\log(a+b)$.

$$\begin{aligned} \log a &= 2{\cdot}8456042 \\ \log b &= 1{\cdot}8068778 \\ \hline \log\frac{a}{b} &= 1{\cdot}0387264 \end{aligned}$$

First, by col. B.	$\log a$	=	2·8456042
Corresponding to $A' = 1{\cdot}0388{,}000$, we have	B'	=	0·0380052
Pro. parts for e', $(=736)$, $\frac{736 \times 84}{1000}$		=	62
	$\log(a+b)$	=	2·8836156
Second, by col. C.	$\log b$	=	1·8068778
Corresponding to $A = 1{\cdot}0387{,}000$, we find	C	=	1·0767136
Pro. parts for e, $(=264)$, $\frac{264 \times 916}{1000}$		=	242
	$\log(a+b)$	=	2·8836156

Problem II. Given $\log a$ and $\log b$, of which $\log a$ is the greater; to find $\log(a-b)$.

Case 1. Let $\log\frac{a}{b} = B = \log\left(1 + \frac{1}{m}\right)$, and consequently $\frac{a}{b} = 1 + \frac{1}{m}$. Solving, we obtain $m = \frac{b}{a-b}$; and $1 + m = \frac{a}{a-b}$. Hence, returning to logarithms,

then is $A = \log\frac{b}{a-b} = \log b - \log(a-b)$,

and $C = \log\frac{a}{a-b} = \log a - \log(a-b)$.

From the last two equations we deduce

$$\log(a-b) = \log b - A \;.\;.\;.\;.\; (3)$$

$$\text{and } \log(a-b) = \log a - C \;.\;.\;.\;.\; (4)$$

Case 2. Let $\log\frac{a}{b} = C = \log(1+m)$,

and consequently $\frac{a}{b}=1+m$. Solving this equation we have, $m=\frac{a-b}{b}$, and $1+\frac{1}{m}=\frac{a}{a-b}$. Consequently,

when $C=\log\frac{a}{b}=\log a-\log b$,

then is $A=\log\frac{a-b}{b}=\log(a-b)-\log b$,

and $B=\log\frac{a}{a-b}=\log a-\log(a-b)$.

From these we deduce,

$$\log(a-b)=\log b+A\ldots(5)$$
$$\text{and }\log(a-b)=\log a-B\ldots(6)$$

The distinction between the two cases is this:—column B contains no value greater, and column C none less, than 0·3010300, which is the logarithm of 2. Any particular example, therefore, will belong to either the first or the second case, according as $\log a-\log b$ is less or greater than 0·3010300. Hence for the two cases we have the following,

Rules:—Case 1. When the difference of the given logarithms is less than 0·3010300 seek it in col. B; the value corresponding in A, subtracted from the less logarithm, or that in C, subtracted from the greater, will give the logarithm required.

Case 2. When the difference of the given logarithms is greater than 0·3010300 seek it in col. C; the corresponding value in A, added to the less logarithm, or that in B subtracted from the greater, will give the logarithm required.

Example 2. Given $\log a=2{\cdot}8836156$, and $\log b=2{\cdot}8456042$; required $\log(a-b)$.

$$\log a=2{\cdot}8836156$$
$$\log b=2{\cdot}8456042$$
$$\log\frac{a}{b}=0{\cdot}0380114$$

Log $\frac{a}{b}$ being here less than 0·3010300, the example belongs to the first case.

First, by col. A. $\log b=2{\cdot}8456042$

Corresponding to $B'=0{\cdot}0380136$, we find $A'=1{\cdot}0387$

Pro. parts for $e',(=22)$, $\frac{1000\times22}{84}$ $=262$

$\log(a-b)=1{\cdot}8068780$

Second, by col. C. $\log a=2{\cdot}8836156$

For $B'=0{\cdot}0380136$, we have, $C'=1{\cdot}0767136$

Pro. parts for $e',(=22)$, $\frac{916\times22}{84}=240$ $1{\cdot}0767376$

$\log(a-b)=1{\cdot}8068780$

Example 3. Given $\log a=2{\cdot}8836156$, and $\log b=1{\cdot}8068778$; required $\log(a-b)$

$$\log a=2.8836156$$
$$\log b=1{\cdot}8068778$$
$$\log\frac{a}{b}=1{\cdot}0767378$$

This example belongs to the second case.

First, by col. A. $\log b=1{\cdot}8068778$

For $C=1{\cdot}0767136$, we find, $A=1{\cdot}0387$

Pro. parts for $e,(=242)$, $\frac{242\times1000}{916}$ $=264$

$\log(a-b)=2{\cdot}8456042$

Second, by col. B. $\log a=2{\cdot}8836156$

For $C'=1{\cdot}0768052$, we find $B'=0{\cdot}0380052$

Pro. parts for $e',(=674)$, $\frac{674\times84}{916}=62$ $0{\cdot}0380114$

$\log(a-b)=2{\cdot}8456042$

It would seem that of the two solutions with which we are furnished for the first problem, and each case of the second, the first solution is generally to be preferred, on account of the more easy determination of the proportional parts. As already hinted, when col. A is used, either as the argument or otherwise, the readiest way of finding these is by means of the printed proportional parts.

Certainly not the least useful and striking applications of Matthiessen's Table are the cases in which one or other of the quantities, a and b, is equal to unity. The rules I have given apply equally to these cases as to every other that may arise. Nevertheless, since in the cases referred to the operations undergo material simplification, it seems desirable to exhibit here the formulæ connected with them. This is done in the following table, which contains also, (numbered 1 to 6,) the general formulæ already deduced.

When	Then if	We shall have	No.
$a>b$	$\log\frac{a}{b}=$ A	$\log(a+b)=\log a+\mathrm{B}$	1
		$\log(a+b)=\log b+\mathrm{C}$	2
	$\log\frac{a}{b}=$ B	$\log(a-b)=\log b-\mathrm{A}$	3
		$\log(a-b)=\log a-\mathrm{C}$	4
	$\log\frac{a}{b}=$ C	$\log(a-b)=\log b+\mathrm{A}$	5
		$\log(a-b)=\log a-\mathrm{B}$	6
$a>1$	$\log a=$ A	$\log(a+1)=\log a+\mathrm{B}$	7
		$\log(a+1)=\mathrm{C}$	8
	$\log a=$ B	$\log(a-1)=$ ar. co. A	9
		$\log(a-1)=\log a-\mathrm{C}$	10
	$\log a=$ C	$\log(a-1)=\mathrm{A}$	11
		$\log(a-1)=\log a-\mathrm{B}$	12
$a<1$	co.log $a=$ A	$\log(1+a)=\mathrm{B}$	13
		$\log(1+a)=\log a+\mathrm{C}$	14
	co.log $a=$ B	$\log(1-a)=\log a-\mathrm{A}$	15
		$\log(1-a)=$ ar. co. C	16
	co.log $a=$ C	$\log(1-a)=\log a+\mathrm{A}$	17
		$\log(1-a)=$ ar. co. B	18

The table is read thus: "When a is greater than b, then if $\log\frac{a}{b}$ = A, (that is, if $\log a-\log b$ be sought in col. A,) we shall have, $\log(a+b)=\log a+\mathrm{B}$, or $=\log b+\mathrm{C}$," and so on. The last twelve formulæ are very simply deduced from the first six, by writing in these 0 for the logarithm of that quantity which is supposed equal to unity, and then, if necessary, changing b into a for simplification. For example, take formula 5, and let $a=1$. Then the argument is, $\log a-\log b$, that is, $0-\log b$, or colog $b=\mathrm{C}$; and the formula becomes $\log(a-b)$, that is, $\log(1-b,)=\log b+\mathrm{A}$; or, changing b into a, $\log(1-a)=\log a+\mathrm{A}$, which is formula 17. And in like manner formula 6 becomes, (a being still $=1$, and the argument consequently as before, colog. $b=\mathrm{C}$,) log. $(1-b)=0-\mathrm{B}=$ ar. co. B, which, changing b into a, is formula 18. I shall give examples of the application of some of these formulæ in another paper.

With regard to the accuracy of the results obtained by the use of Matthiessen's Table, I have no hesitation in saying, that these are at least as much to be relied on as analogous results obtained by the use of the common tables. Every tabular conversion has a tendency to produce some error, small it may be in most cases, but still sensible; and more especially so when the differences in the argument column are *less* than those in the column against which it is used. Now to find by the common tables results of the kind at present under consideration, two conversions at least are necessary, and in one of them the differences will be in the unfavourable condition just noticed. In using Matthiessen's table, on the other hand, only one conversion is requisite; and in it, when A is used against either B or C, or C against B, the differences will be in the condition most favourable to accuracy. In using B, however, against either A or C, some deviation from strict accuracy

may be expected. In the result of Example 2, for instance, there is a deviation of 2 in the last place, as appears by a comparison of that result with the data in Example 1. But this arises from the nature of the case, and not from any defect in the table; and it may be expected to increase as the difference between log a and log b decreases. The common tables applied to the same example give values, according to the methods employed, still more remote from the truth.

I shall continue the subject in another paper. Meantime, I remain, Sir,

Yours respectfully,

G.

Hermes-street, Pentonville,
June 14, 1844.

MR. JOPLING'S SEPTENARY SYSTEM OF GENERATING CURVES.

More than twenty years have elapsed since Mr. Jopling first gave to the world his Septenary System of Generating Curves by simple continuous motion; but though, at the time it attracted a good deal of attention, was much canvassed in our own* and other journals, and greatly commended by the most competent judges for its ingenuity, and probable usefulness, it has never been productive of any practical results, and has long since ceased to be mentioned, either for praise or dispraise. Gregory, Christie, Barlow, Tredgold, (P.) Nicholson—all men of first-rate eminence as geometricians—agreed in anticipating the greatest benefits from it—not only to mathematical science, but to the whole range of the constructive arts. In a Testimonial to which, the first four of these distinguished names are appended, dated in Aug. 1823, they say, in reference to an apparatus for carrying the system into effect: "To mathematicians the use of this apparatus will suggest a variety of enquiries in reference to new and curious curves whose properties have not as yet been investigated; while to architects, shipwrights, engravers, and many others it will be found subservient to the most fertile and interesting applications." Mr. Nicholson—himself the inventor of the first true method of generating the oval—in a separate certificate, dated June 20, 1825, pronounces it to be "invaluable to the architect, the engraver, and to all those who are engaged in the ornamental departments of the arts." To what then are we to ascribe the state of oblivion to which an invention, so well thought of at the time of its promulgation, has since fallen? Certainly to no misjudgment on the part of those who praised it so highly, for to this day no one has offered, either to impugn the soundness of the principles on which the Septenary System is founded, or to question its extensive adaptability to practical uses. The real cause of the unmerited neglect which it has experienced, we take to be of a two-fold nature. In the first place, it has never been more than partially developed, which involves, as a necessary consequence, that it can only have been very partially understood by the general mass of readers; secondly, it has been left in this half-fledged state, not from any want of endeavour on the part of its author to push it into notice, but from a want of adequate encouragement and assistance on the part of the public, or at least, of those by whom the patronage of the public, in its collective capacity, is administered. We quote from what Mr. Jopling himself has said on these points:

"The discovery was announced in a small pamphlet in 1823, and in 1825 the first number of a work was published, describing the several motions of the first division of the System, accompanied by a description of a particular construction of the 'Double Crank Apparatus;' and during a period extending over several years, every effort was tried to make known the Invention by the author. It had been foreseen that a *great work* was required, containing numerous examples for reference; so that any line being there registered, it might be again reproduced at pleasure to any scale required; and that these several examples being properly arranged should point out how to adjust the apparatus so as to delineate other varieties, and to pass with facility from one line to another. But the very great expense and the length of time requisite to produce such a book in the way then contemplated, deterred the author from attempting it on his own responsibility; and whi-

* See particularly *Mech. Mag.* vols. 8—12, 13 and 16.

he received abundant testimonials as to the originality and to the great utility of his invention, *he had no offers of assistance, although the necessity for government aid had been pointed out by others.*"

Single handed he could advance no further in the "great work" required than a "first number," and there the matter has rested for many a long year. Dispirited, doubtless, yet still not quite despairing of ultimate success, Mr. Jopling has this year ventured on one effort more to rouse the attention of the public to the advantages of his system, by the production of a second number of his work.* The time is certainly favourable to a revival of the subject, and so far Mr. Jopling may be justified in hoping for the best. The arts of design are more than ever they were before objects of state encouragement. Schools for instruction in them have been established under the superintendence of a "Committee of Council," and Act after Act passed for better securing to the authors of new designs the fruits of their labours. Now, here is a system which is unquestionably calculated to promote these arts in a very high degree. Could the "Committee of Council," then, do anything more in consonance with the course of policy to which it owes its appointment, than to take that system under its fostering care? Could a few thousands of the public money be better expended than in bringing it to maturity, or rather (for theoretically the system is already perfect enough) in spreading a knowledge of it among those who can best turn its rare capabilities to practical account?

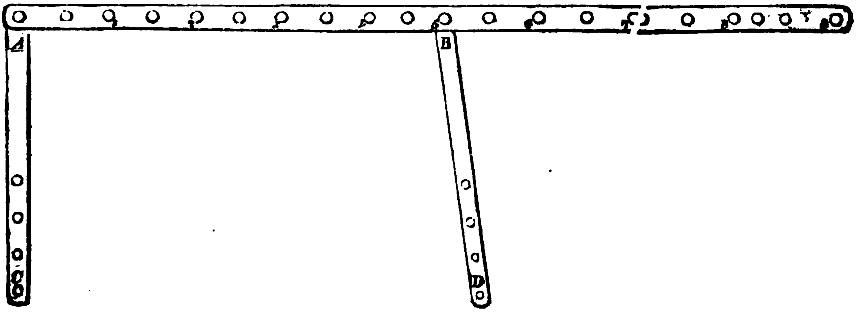
But what is this Septenary System of which we speak? And why is it so called? It is called *Septenary*, because it is supposed to comprehend, under *seven* divisions, the whole of the curves which can be generated by the continued motion of a point—not only all those which have been heretofore known, named and described, as the circle, the cardioid, the cissoid, the conchoid, the cycloid, the epicycloid, the ellipsis, the evolute, involute, &c., but innumerable others never before generated or described, or included in any geometrical nomenclature; or if generated, whether designedly or accidentally, by methods of which no record or trace remains. The seven divisions of the system are formed by different modes of regulating the motion of one plane in contact with another plane at rest, by poles, right lines, or circular lines; and are as follows:

Two poles on one plane Two circular lines on the other plane	1st.
Two poles on one plane Oneright line, and one circular line on the other plane	2nd.
Two poles on one plane Two right lines on the other plane	3rd.
One pole on one plane One pole on the other plane	4th.
A pole and a right line on one plane A pole and a right line on the other plane	5th.
A pole and a right line on one plane A pole and a circular line on the other plane	6th.
A pole and a circular line on one plane A pole and a circular line on the other plane	7th.

In the First No. of his work published in 1825, Mr. Jopling described an ingenious double crank apparatus of his invention, by which all the varieties embraced by the first of these divisions (except one) might be produced; and by additions to, or modifications of which (if we understand him rightly) the entire Septenary System may be worked out. In his present number he has presented us with this apparatus in a simpler, and of course, less efficient form. This is retrograding somewhat; but he does so, in the hope that,

* "No. II. Septenary System of Generating Lines by Simple Continuous Motion. Illustrated by ten plates, containing Examples and Registers of a few hundreds of the Curves produced by Jopling's Double Cranks of the most simple construction. London, 1844, published by the Author, and sold with the Double Cranks, 29, Wimpole-street."

by beginning again at the beginning, and making the matter a little plainer to popular comprehension, he may stand a better chance of at length securing that patronage for his system which it has hitherto unluckily failed to obtain. Of this simpler form of the apparatus the following engraving exhibits a top view.



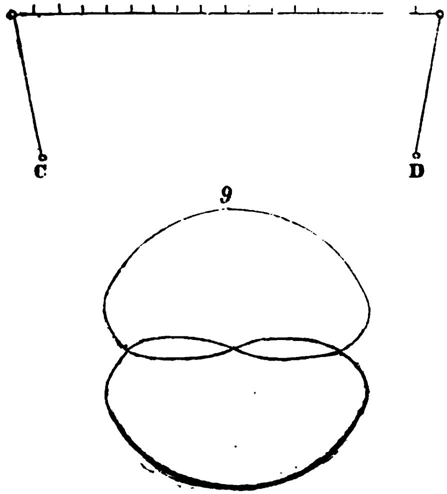
We subjoin Mr. Jopling's own description of the apparatus.

"This apparatus consists of three pieces, and may be made of any material. The one now offered to the public is of box-wood, with ivory pins and steel points; these being considered the most suitable materials for the attainment of the object at present in view.

"The two smaller pieces, (C D), called '*the Cranks,*' are each 3½ inches long, having on their upper side a fixed ivory pin at one end. Each has also four holes commencing at the middle, and toward the other end half an inch apart, for the purpose of introducing the steel points, and thus allowing the same cranks to describe longer or shorter arcs or circles. For many curves this answers every purpose, but when the cranks are placed near to each other, cranks no longer than actually required become necessary. Any variety may be had, but it was thought better to keep the instrument as simple as possible until the use of it is better known, and especially as the present cranks produce so great a variety of forms.

"The third piece (A), which may be considered a portion of the tracer plane, and is therefore called the *tracer bar*, is 10 inches in length, and perforated with holes half an inch apart, to receive the fixed ivory pins projecting from the upper side of each crank, and also for the purpose of placing a pencil in any one not occupied by the pins of the cranks, when drawing the curves.

"By means of a steel point, each crank is attached by any of the appropriate holes to a drawing board,* or paper, at any distance required within their range, and the tracer bar by means of any of the holes also within the range of the cranks, is placed upon them Suppose the whole plate adjusted in the proportion shown in fig. 2; the steel points C and D being adjusted 8 inches, and the pins A and B 9 inches apart. The apparatus is then ready for drawing, and if a pencil is introduced in the centre hole 4½ inches from each end (numbered 9), the tracer bar being moved as the cranks direct, the pencil will describe the curved line, also No. 9 in the plate, to four times the scale of that figure.

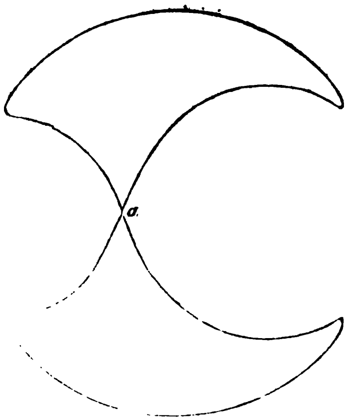


* The drawing board is best made of soft wood, as American Pine, which is at the same time the cheapest material. When only one line or so is required to be drawn, a very short steel point will be sufficient to hold the instrument. The same effect as short points may be obtained by putting one or more thicknesses of card board under the cranks and by passing the points through them.

"To draw the same line of greater dimensions, (say feet for inches,) take any three slips of wood of the proper length, connected and fixed in a similar manner with common screws or pins, and with a hole for a pencil in the same position; then the line may be drawn by any workman upon a floor."

In the same way, by altering the relative position of the cranks of this simple apparatus, many thousands of curves, every one different from the other, may be produced; and by making some additions to it, it might, we understand, even admit of the almost incredible number of *one hundred million adjustments.*

The better to illustrate the utility of the invention, let us take the following example from the plates which illustrate Mr. Jopling's present Number.



Here is a figure produced by a particular arrangement of the apparatus; it might, we fancy, be a very useful form to give to a stern propeller; but suppose it were the very best possible form that could be adopted for that purpose; and supposing farther that it had been somehow or other obtained by chance, and that Mr. Jopling's double crank apparatus had never been heard of, how could a workman be instructed to reproduce it on a large scale? You can tell him to make a blade of the form of any segment of a circle, or section of a cone, or of any other *known* figure, the mode of generating which is also *known;* but if your form is one never seen nor heard of before; and if you know not by what means it is to be reproduced, how is it possible to convey an intelligible idea of it in words? The utmost you can do is to give a drawing of the figure, and direct the workman to make an enlarged copy by means of a pentagraph, itself enlarged much beyond all ordinary dimensions—a method of obvious inconvenience, and subject to all the chances of inaccuracy arising from every sort of mere copying, where the most indifferent error on a small scale becomes magnified by increase of size into one of importance. But, with Mr. Jopling's apparatus, all difficulty instantly vanishes. You have but to tell the workman the numbers of the holes in the tracer bar, by inserting the steel points of the cranks in which, the figure in question was produced, and he can then, with three slips of wood, as explained in our previous extract, make an instrument that will re-produce that figure with unerring exactness on any desired scale.

Of the shifts to which constructors are sometimes actually put, from the want of recorded information of the proper method of reproducing certain peculiar curves, the practice of our modern imitators of Gothic architecture is particularly rife with examples. In what manner many of the beautiful lines for which that style is remarkable may be *truly* generated no one can tell, and the best copies which we see of them, are but imperfect approximations, obtained by an infinitude of empirical artifices, governed by no sort of principle whatever. Mr. Jopling has already detected several of these forms in the curves produced by his apparatus, and he makes no doubt that it will be found capable, by diversity of adjustment, of generating the whole of them. He infers from this fact, and we think with good reason, that "some such method of producing" the peculiar lines they adopted "must have been known to our Gothic ancestors."

Perhaps, however, the value of Mr. Jopling's apparatus consists less in its enabling us to reproduce old forms with correctness, than in the infinite number and variety of new forms which it may be the means of bringing us acquainted with, and in fact of *creating,*

In this respect it has powers of production far transcending any belonging to human invention itself. A skilful artist may by a chance sweep of his pencil produce now and then a symmetrical curve worth repeating and perpetuating; but can he produce *millions* all alike symmetrical (for symmetrical every figure generated by this apparatus must be)? And amidst these millions of new and symmetrical forms how many may there not be, which might be made use of with advantage in our arts and manufactures—thus contributing at once to the improvement of the national taste, and to raising the character of our products in the markets of the world?

To give names to such a multitude of lines, or to describe them in any way by words, is of course impossible; but the particular adjustment of the tracer bar and cranks necessary to the production of every one of any number of curves *could* be registered by figures in the manner before explained. And hence the appeal made by Mr. Jopling, for public assistance to enable him to produce a work worthy of the occasion and of the country—one containing, if not the whole of the curves belonging to each of the seven orders or divisions, as large a number of specimens of each as might suffice to convey some idea of their general character. After the past indifference shown to Mr. Jopling's labours we cannot feel very confident that this appeal will meet with the success which it deserves; but of this we are certain, that the matter cannot be left where it is, without reflecting the utmost discredit on the intelligence and liberality of the country.

NOTE TO MR. PRATER'S ESSAY ON LIGHT, IN REFERENCE TO ITS DISOXYGENATING POWER ON PLANTS.

Before beginning the express subject of this Note, I may observe that there seems a certain antagonism between light and heat; the former, as a general principle, being a deoxidizing, and the latter an oxidizing power.* In a paper read at the British Association last year, Prof. Draper has confirmed Dr. Daubeny's experiments, which went to show that the light of the sun (*i. e.* the rays, according to Sir W. Herschell, situated near the centre of the spectrum) is the agent of disoxygenation in the case of plants. Prof. Draper further asserts that the rays at and beyond the violet end of the spectrum (*i. e.* the so-called chemical rays) are without effect in this case. Prof. Draper seems to regard the evolution of oxygen under such circumstances as a sort of transposition of elements brought about by the agency of light. The leaves seem to assimilate all the carbon of the carbonic acid gas and part of its oxygen, and give out an equal volume of nitrogen for the oxygen, as well as the *remaining portion* of the oxygen that went to form the carbonic acid gas. *Thus nitrogen is always exhaled with oxygen in this case.*

Taking these experiments as correct, the action in this case would not appear so completely one of disoxygenation as in the case of the reduction of the oxides of gold, &c., at the violet end of the spectrum; for the oxygen gas may perhaps be given out *ready formed*, with an equal volume of nitrogen, and carbonic acid gas not be decomposed at the place given out, or if so, only *indirectly*. Besides, I see no notice taken of Tiedemann's assertion (see beginning of my Essay) which experimentalists on this subject should repeat very carefully. It is right also to add that Mr. R. Hunt asserts that his experiments have not hitherto supported those of Daubeny and Draper on this point.

Under all these circumstances, I must consider this question unsettled; nor do I see that it will materially affect my theory whichever way it is decided. If the action is due solely to *light*, and is decided as one *purely* disoxygenating, I shall only then have to consider it very probable that light itself as well as *the invisible rays*, contains hydrogen—a conclusion indeed, with regard to light generally, which may not *be actually proved* for centuries (supposing it true) owing to our imperfect apparatus and balances.

H. P.

* This is an obvious fact, whether they contain, or *under certain circumstances* generate the antagonistic bases, oxygen and hydrogen, in minute proportions, or not.

ROTARY ENGINES—MR. JONES'S—MR. BORRIE'S.

Sir,—The forcible arguments occasionally used by Mr. Peter Borrie, I do not find in his reply in your Magazine of the

8th inst. to my previous letter respecting the *rotary* steam engine of Mr. Jones and Mr. Borrie's "*revolving* steam engine" upon his "patent principle," which term *revolving* I understand in contra-distinction to *fixity;* but wherein *revolving* differs from *rotary* I do not comprehend.

It is not the gaudy trappings of polished iron and brass with which a steam engine is dressed up—nor pompous delineations of its supposed merits—nor pages of calculations and figures in tables to show quantity and pressure of *vapour*—nor instructions how the force of a theory may be comprehended, which has not practically been demonstrated to be a reality—that deceive the eye of science; but it is ***simplicity of combination of means to an end*** which science admires, and which constitutes intrinsic merit.

Without entering into a detail of the comparative advantages of the various steam engines that have been projected from the time of Hero* down to the present period, I will in a few words endeavour to place in juxtaposition the inventions (although Solomon says "there is nothing new under the sun") of Mr. Jones's Rotary and Mr. Borrie's "Revolving" steam engines; and without puzzling your readers, Mr. Editor, with a multiplicity of figures, diagrams, &c. &c., I will simply state that the main feature of Mr. Jones's invention (and such it really is in the following respect) consists in the arrangement of the steam passages and ports, by which two of the three sliding pistons, *f f f*, are simultaneously acted upon by pressure of steam, thereby assimilating and gaining the advantage possessed by his Cambrian engine, (shown by the plan and description of fig. 2 in No. 986 of your Magazine,) viz. the same simultaneous action of steam upon one side or surface (opposite, of course) of both the radial arms of the piston of that engine, which, however, can be constructed with three radial arms, presenting the advantage of steam pressure upon two of the three, similarly to the arrangement of the slides of his (Mr. Jones's) rotary engine; and thus by these arrangements, the cylinder of both Mr. Jones's engines are proportionately less in diameter or dimensions than those that have only one slide if rotary, or one arm if oscillating, which slides or arms constitute the working parts of the piston exposed to the pressure of steam. Herein consists the invention and superiority of Mr. Jones's steam engines, independently of simplicity, when compared with Mr. Borrie's engine, which, although on the condensing principle, (and Mr. Jones's can be so constructed,) is nevertheless, as I conceive, if not an infringement, at least a copy of Mr. Jones's and certainly not equal to it, for the reasons stated. But if proof is required as to plagiarism on Mr. Borrie's part, I refer you, Mr. Editor, to your Magazine of 7th February, 1824, in which is described the rotary engine patented some time previously by Mr. Job Rider, on the slides of which engines (vanes Mr. Rider calls them) the steam pressure acts upon one and consecutively on the others as they rotate and diverge in and to the internal surface of the outer cylinder, precisely as Mr. Borrie's engine; consequently, in this respect, his engine and Mr. Jones's resemble Mr. Rider's; but the marked and main feature and improvement of Mr. Jones's is—that the pressure of steam acts simultaneously upon two of the slides instead of one only, as is the case with the other engines of Mr. Rider and Mr. Borrie.

However, as the old proverb says, "A thousand hard words will not break any bones," and as deeds strike more forcibly than words, I challenge Mr. P. Borrie—not upon the terms he challenges me in his letter of vindication "to make a drawing and description" of Mr. Jones's rotary engine, the analysis required I now present to him, whereby I consider that I have shown wherein consists the superiority of Mr. Jones's rotary engine over his—I say, I challenge Mr. Borrie to a trial of his *revolving* engine with Mr. Jones's *rotary*, and if accepted, I will place in your hands, Mr. Editor, and under your control, the identical high pressure engine patented by Mr. Jones, in order that Mr. Borrie may make an engine of the same class on his patent revolving principle, with slides of the same size and surface as those of Mr. Jones's rotary; and then, by such trial, under your direction, Mr. Editor, the public will be able to judge correctly, which of the two engines deserves their notice, still being of opinion, as I am, that the Cambrian half-beam oscillating piston direct-acting engine is preferable to either; but as the rotary is an adopted child, I am bound to protect it.

And thus, Mr. Editor, I should have

* Hero is supposed to have been the first inventor of a rotary steam engine, although Homer seems to have had some notion of steam power, as the following quotation from his Odyssey will show. (Pope, book 8, page 175.) The poet is describing ships of king Alcinous.

"So shalt thou instant reach the realm assign'd,
In wondrous ships, self-moved, instinct with mind,
Though clouds and darkness veil the incumbent sky,
Fearless through darkness and through clouds they fly;
Though tempests rage—though rolls the swelling main,
Ev'n the stern god† that o'er the waves presides,
Safe as they pass and safe repass the tides,
With fury burns; while careless they convey
Promiscuous ev'ry guest to ev'ry bay."

† Neptune then—Steam now.

concluded; but as Mr. Borrie, by his remark (irrelevant to the subject), "that from what I have had to do with hydraulic presses, I know that it requires some *practice to make them,*" permit me to observe in reply to the insinuation conveyed by these words, that, such as my knowledge is of hydraulic presses, Mr. Borrie has been glad enough to avail himself of it in the erection of certain presses constructed under his superintendence (through my introduction)—that though I do occasionally, like other engineers, supply hydraulic pumps as well as presses, I have never advertised such pumps as *patent* when I had no patent for them—and that neither have I ever applied for any patent for an hydraulic engine which I was afterwards obliged to abandon. Anon, the matters to which I allude shall be more fully explained through another and more proper channel than the pages of your valuable Magazine.

I remain, Mr. Editor,
Your obliged servant,
H. C.

59, King William-street, 11th June, 1844.

NEW STEAMERS.

A new steamer, called the *Princess Mary*, has been just built for the South Eastern Railway Company, by Messrs. Ditchburn and Mare, and fitted with annular cylinder engines, on the patent plan of Mr. Joseph Maudslay, constructed by the firm of Messrs. Maudslay, Sons, and Field. On Tuesday last she made a trial trip, which resulted in what may be considered as a trial of speed between her and the *Prince of Wales* and *Isle of Thanet*, reputed to be two of the fastest vessels belonging to the port of London.

The *Isle of Thanet* left Blackwall at 10h. 37 min., the *Prince of Wales* at 10h. 41 min., and the *Princess Mary* at 10h. 44 min. All three vessels then proceeded in this order. At Gravesend the *Prince* stopped for one minute to let a passenger out; but after getting under way again she was still considerably ahead. The *Princess* being built expressly for a sea boat, and to take the ground in Boulogne and Folkestone harbours, draws 18 inches more water than either of her opponents, and was obliged, therefore, between Blackwall and Gravesend, to keep out in the stream, whilst the others kept close in shore, in the slack of the tide, which was running up very strong. After passing Gravesend, it was soon seen that neither of the competing vessels could hold with the *Princess*. She then began to gain on the *Prince of Wales*, the latter at the same time coming up rapidly with the *Isle of Thanet*. At the Nore Light, the three vessels were still in the order of starting, but quite close to each other, and in a very short time (at 2 h. 7 min.) they were all three abreast. In ten minutes more the *Princess* was far enough ahead to cut right across her two rivals, *and sweep round both.* None of the vessels had sail set, the wind being right ahead, and the constant and copious escape of steam from the respective waste steam heads showed that all three were doing their best to win. The *Prince of Wales*, hitherto *believed* to be the fastest, and the *Isle of Thanet*, *said* to be the fastest boat afloat, must now yield the palm to the *Princess Mary*.

Between Blackwall and Woolwich the *Mary* came up with another crack vessel, the *Waterman, No.* 11, and passed her easily. When off Sheerness, going down, she met the *Fawn*, which has also a high reputation for speed, going up with a strong tide in her favour; and, after proceeding against wind and tide to the east end of the Isle of Sheppy, to the point where she went round the *Prince* and *Thanet*, she overtook on her return the *Fawn* in Northfleet Hope, passed her, and arrived at Blackwall in time to land her party, and be moored, before the *Fawn* made her appearance.

The *Princess Mary* is 143 feet long, and 20½ feet broad; her draft of water is 6 ft. 3 in. The engines are of the collective power of 120 horses; the boilers tubular; and the wheels of the same feathering description as those fitted to the *Princess Alice*, which were described in the *Mechanics' Magazine*, Sept. 16, 1843.

It may be right to observe that the *Princess Mary* had on board on this occasion, in addition to a numerous party of visitors, a great number of workmen, engaged in finishing the cabin fittings, so that the competing

vessels cannot be considered as having laboured under any disadvantage from having passengers on board; certainly neither of them carried more than the *Princess*.

The Gipsy Queen, said to be the largest iron steamer ever built on the river Thames, has been also launched this week from a new yard established by the Messrs. Samuda, at Orchard-place, Blackwall. Her length, from the figure-head to the taffrail is 197 feet 6 inches, and between perpendiculars 175 feet; her breadth between the paddle-boxes is 24 feet. Her burden is 496 tons. Her engines, which are on a new plan, patented by Messrs. Samuda, are of 240 horses power. They are to be placed fore and aft, and not, as the engines of most steam vessels are, on each side of the keel; the cylinders will be directly over the keel, and being in one frame-work, it is expected that all strain will be avoided on any part of the vessel; their total weight, including boilers, &c., which are tubular, water and paddle-wheels, is only 87 tons. The form of the steamer is well calculated for speed. She has a considerable rise of floor, and for a sea-going vessel (she is built for the Waterford Steam-packet Company, and will travel between London and Waterford) her lines are remarkably fine.

MECHANICAL CURE OF CATARACT.

Sir,—Your correspondent, Mr. George Cumberland, Sen., may have made optics a branch of study, but he has evidently but little experimental knowledge of the structure of the eye, or he would have been aware that the crystalline humour is not of a consistency which admits of any part of it being withdrawn through the tube he proposes to use. There is a small quantity of a pellucid fluid between the lens and the delicate capsule in which it is enclosed, but the disease called "Cataract" is generally admitted to consist of an opacity of the crystalline itself, the least dense portion of which (for your correspondent's information) is much too thick to be drawn off through a narrow tube. In cases, if any such there be, where the opacity resides in the *liquor morgagni*, it might be possible to withdraw that fluid in the way your correspondent suggests; but with what "purer fluid" he would replace it, or whether he supposes any fresh secretion would take place, he has not ventured to state.

I do not wish to depreciate your correspondent's suggestion, but I may perhaps be allowed to remind him that he will fail to share the laurel with the "carpenter of St. Thomas's hospital," unless he become more practically acquainted with the subjects on which he ventures to address the public.

I am, Sir,
Your obedient servant,
T. C. Mayhew.

Waltham Abbey, June 12, 1844.

SOCIETY OF ARTS.

The following is a list of the premiums awarded in the Mechanical Arts at the last annual distribution of this Society:

To Mr. P. Lucas, 19, Hyde-park Gardens, for a self-adjusting step-ladder for wharfs, the silver medal.

To A. E. Brae, Esq., Leeds, for his improved chimes for house clocks, the silver medal.

To Mr. R. Brown, Ewell, Surrey, for his improved method of making ornamental grooved ridge tiles, the silver medal.

To Mr. Cornelius Varley, 1, Charles-street, Clarendon-square, for his improved lever microscope, the gold Isis medal.

To Commander H. Downes, R.N., Ladbroke-terrace, Notting-hill, for an annular scupper mouth for ships' decks, the silver medal.

To Mr. Bowery, Bermondsey, for an improved clamp for joiners, the silver medal.

To Mr. S. Franklin, Fleet-lane, for an improved plumbers' force, 3*l*.

To Mr. S. Nicholls, 19, Harrold's-row, Green-bank, St. George's East, for an improved cramp for carpenters, the silver Isis medal.

To Mr. W. F. Warner, 11, Spann's-buildings, St. Pancras, for his improved ruling machine for engravers, the gold Isis medal.

To W. F. L. Gompertz, Esq., 236, Maida Vale, Edgeware-road, for his method of anatomical modelling, the silver medal.

To Mr. J. Franklin, 91, Goswell-road, for his expanding centre-bit, the silver Isis medal and 2*l*.

To Mr. J. Common, Denwick, Northumberland, for his mode of putting new roots to old trees, &c., the silver medal.

A VISION—OF SMOKE ABOLISHED AND GARDENING IN THE ASCENDANT.

Sir,—Last evening, my daily labour done, I sat in my arm chair, with my feet on the fender and my eyes shut, smoking my pipe,—"Consume the smoke! what a pother you make," said my wife. "If I do, it won't make me fat," I answered. "Consume the smoke? consume the smoke?" continued I to myself, musing; "it is what many are trying to do, and what some have, in limited circum-

stances, to a limited extent, accomplished, but whose plans will never be generally adopted. Mr. C. W. Williams's patent acts well, apparently, when applied to the great furnaces in manufactories; it does away with the *visible* smoke, *alias* the unburnt coal, *alias* the carbon, but it converts it, by its union with the oxygen of the atmosphere, into carbonic acid gas, which, in my opinion, is quite as injurious to the constitution of those who breathe it, as the mere dust or soot, that is, the visible smoke, would be. The only question therefore is, whether or not, to obtain sufficient heat, it is necessary, by increase of fuel, to generate as much carbonic acid gas in addition to the unburnt coal, or visible smoke, without the consuming apparatus as would be generated where the visible smoke is consumed? For even supposing that by its mixture with the atmosphere, the carbonic acid gas is so much diluted as to be rendered innoxious, the benefit promised can never be appreciated, in this neighbourhood at least, either on the score of health or cleanliness, there being for one furnace where the conditions can be complied with, 30 coke fires, and from 200 to 300 fires in open grates where they cannot. Yet its accomplishment (the means of getting rid of the nuisance) is looked upon as a very grave matter, for even Parliament deems it worth its interference, and many talented, respectable, and wise men are engaged in devising means to effect the object, or in endeavouring to carry out the means already known.

"What is the origin of coal? It is generally supposed to be vegetable. How is this opinion supported? By finding the remains of vegetable substances only partly converted, and by a comparison of the products of coal, and of vegetables when subjected to chemical analysis. Coal contains carbon, hydrogen, sulphur, ammonia, lime, alkali, tar, &c., and so do vegetables—"

"Have you heard anything from the landlady concerning the candle-house you want to build?" asked my wife, interrupting the flow of my ideas. "No, only that a gentleman is gone over to Belgium, who will see her there, and return with an answer in about ten days," said I, and resumed my meditations thus.—"How shall I arrange the building most advantageously? I will have the walls so—the windows here—the door there—the roof to slope. I don't know how the roof should slope to be most cool. Have a flat iron roof, and cover it with soil for a garden! Yes, enclose the garden, and cover it with glass for a greenhouse, said the spirit within me; have a chimney a-top with a strong draft, to draw the smoke from the furnace below through the soil. You may do that if you have an iron ceiling, iron rafters, and perforated iron plates above to carry the soil. The soil will absorb the carbonic acid gas, the water, sulphur, ammonia, and other matters generated by combustion, and it will arrest the particles of soot, and so the fire will manure the soil, feed the plants, water them, and heat them all at one and the same time. As the plants deprive the soil of these alimentary ingredients, they will be replaced continually; for while the fire is burning, atmospheric air, uncombined with the products of combustion, will pass up the chimney, circulate under and through the pores of the soil, in sufficient quantity to furnish oxygen and nitrogen to perform their functions in the vegetative economy. A portion of ashes may occasionally be carried up and mixed with the earth. Yes, make a garden, plant your seeds and shrubs therein, give them smoke to eat, smoke to drink, and smoke for clothing to keep them warm. You will then be able to consume the smoke, and fatten upon it. Bravo! Excellent idea! I will fill my pipe again, and examine the soundness of it; for if it be as good in practice as it now seems in theory, in course of time all the house-tops may be converted into gardens, and that destruction, to all agricultural purposes, of the earth's surface, consequent on the building of large manufactories, towns and cities, will be half prevented; diseases malignant as various, caused by the influence of smoke, will vanish from among us; that which is now a curse will be a blessing; smoke will no longer be a nuisance."

Such, Mr. Editor, were my speculations; if you think them worth insertion in the *Mechanics' Magazine*, they are at your service. I should be very glad to see the subject taken up by some of your more talented correspondents; it is by no means so extravagant as at first sight may appear. I have asked myself and others why some vegetables do not thrive in the neighbourhood of large towns? The answer is, The smoke is injurious. To the question, How does the smoke act upon them all? all the answer I can obtain is, that it deposits itself on the leaves, stops the pores, and obstructs the perspiration. But this would not be the case if it were applied to the roots only; soot is well known to be an excellent manure; so is the lime impregnated with ammonia, sulphur, &c. from the gas works; carbonic acid gas is not injurious; on the contrary, its presence is necessary to the leaves and roots also; and I have never heard that seeds would not germinate as well in towns and their vicinities as in the open country.

I am, with much respect, yours,

E. MATTHEWS.

Wolverhampton, May 17, 1834.

DRAYTON'S NEW MODE OF SILVERING GLASS.

According to the ordinary mode of silvering glass, a surface of tinfoil is first bathed with mercury, and then flooded with it. On this tinfoil the plate of glass, having been previously cleansed with extreme care, is so floated as to exclude all dust or dirt; this is accomplished by the intervention of $\frac{1}{8}$ in. of mercury (afterwards pressed out by heavy weights) between the reflecting surface of the amalgam of the mercury and the glass; and when the glass and amalgam are closely brought together by the exclusion of the intervening fluid metal, the operation is completed. By the invention of Mr. Drayton, the mercury and tin are entirely dispensed with. The mirror is, for the first time, literally speaking, *silvered*, inasmuch as silver is precipitated on it from its nitrate (lunar caustic) in the form of a brilliant lamina. The process is this: on a plate of glass, surrounded with an edge of putty, is poured a solution of nitrate of silver in water and spirit, mixed with ammonia and the oils of cassia and of cloves. These oils precipitate the metal in somewhat the same manner as vegetable fibre does in the case of marking ink—the quantity of oil influencing the rapidity of the precipitation.

NOTES AND NOTICES.

Heath's Cast-Steel.—Before the introduction of Mr. Heath's process (which consists in adding carburet of manganese to the melting pot) all steel which was to be worked into a fine edge was made of iron procured from one mine only, that of Dannemora, in Sweden. It was consigned to a house at Hull, at a cost of 38*l.* per ton, in quantities not exceeding 1100 tons per annum, and marked L in a hoop. The price limited its use; but by means of this patent the inferior sorts of iron, as those at 15*l.* per ton, may be made available. Steel is made by it which has all the beauty of cast-steel, and all the welding advantages of shear-steel. In the manufacture of table-knives its advantages have been manifest. Formerly these articles were made by tilting or rolling square bars of steel into the necessary shape, thus making blade, shoulder, and tang in one piece; so difficult was this process, that two wasters in a dozen knives were always thrown aside, and workmen's wages were double. Now, the steel blade, made by this process, is welded with the iron tang.—*Mining Journal.*

Air Propelled Locomotive.—The following description of a new locomotive has been addressed by Mr. J. B. Cotter to the *Railway Chronicle*:—The writer describes the machine as propelled by condensed air. "I cannot express in sufficiently strong terms my gratification and astonishment when I was placed by the inventor on his carriage, which he immediately put in motion, and gradually increased its speed until it attained a rate of more than thirty miles an hour. This engine was brought out last March, and the trial I witnessed took place on the left bank of the Versailles Railroad. During its progress I examined the working of the machinery with the greatest attention, and almost every part of it appeared admirably adapted to its purposes. The only fault I perceived was in the workmanship of the pumps and pistons, which I must admit are not of the first order, a defect that would at once be remedied in this country. M. Andrand's first experiments were made in 1840, and he has since followed them up with the greatest assiduity and success. The engine runs on the rails with perfect ease, without noise, fire, smoke, or danger. The recipient is a beautiful piece of workmanship. The air with which it is charged is conveyed by copper pipes to the regulator, then to the dilator, and from it to the cylinders. To put the carriage in motion the stop-cock is turned; to cause a reverse movement you have only to press on a button, which changes the action of the side valves, and the engine is backed."

Great Western Steam-Ship.—A curious dispute has arisen between the Peninsular Company and the Great Western Company. The former, it appears, purchased the ship *Great Western* for 32,000*l.*, the owners undertaking to do whatever the Admiralty surveyors might deem necessary to qualify the vessel for the mail service. A considerable delay taking place in completing a set of new boilers on the tubular principle, some time was requested and granted. All being ready, a trial was had down the Severn, under the inspection of the Admiralty surveyor, who found all right with the exception of the supply of steam, on which he declined to pass the survey. Some alterations having been made in the boilers, the vessel was announced as ready for a second trial, at the request of the owners. A delay of a few days occurring in sending the Admiralty surveyor down, the owners, with Captain Claxton, the manager, took on themselves to withhold the vessel, thus virtually cancelling the contract, and, without notice to the Peninsular Company, advertised her departure for New York. The Peninsular Company feeling that whatever the delay might have been, it was not to be laid to their account, but to that of the Admiralty, and not being disposed to yield to this summary extinguishment of what was considered a desirable purchase, an application was made to the Court of Chancery to prohibit the vessel being sent to sea, and immediately granted.—*Liverpool Albion.*—The injunction has been since dissolved.—Ed. M. M.

Steamers in Siberia.—A letter from St. Petersburgh, of May 26, states that the Government has just granted to M. Theodore Pasnilau, a merchant of Tobolsk, an authorisation to establish steam-boats in Siberia, on the Lake of Baikal, and the rivers Ab, Tobol, Irtish, Jenissei, and Lena, on condition that two boats shall commence plying before the end of the year. The building of these vessels, to be called the *Emperor Nicholas* and the *Czarewitch*, is now going on; they will be the first steamers introduced into Siberia.—*Mining Journal.*

The Artesian Well of Grenelle.—The volume of water supplied by the Artesian well of Grenelle was measured a few days ago, and found to have lost nothing of its force or quantity. The source furnishes 2,000,000 quarts of water per twenty-four hours, which is more than sufficient for the consumption of the quarter of the Pantheon, where immense reservoirs have been constructed to receive it. The water is as limpid as filtered Seine water, and has continued clear since tubes have been inserted in the aperture.

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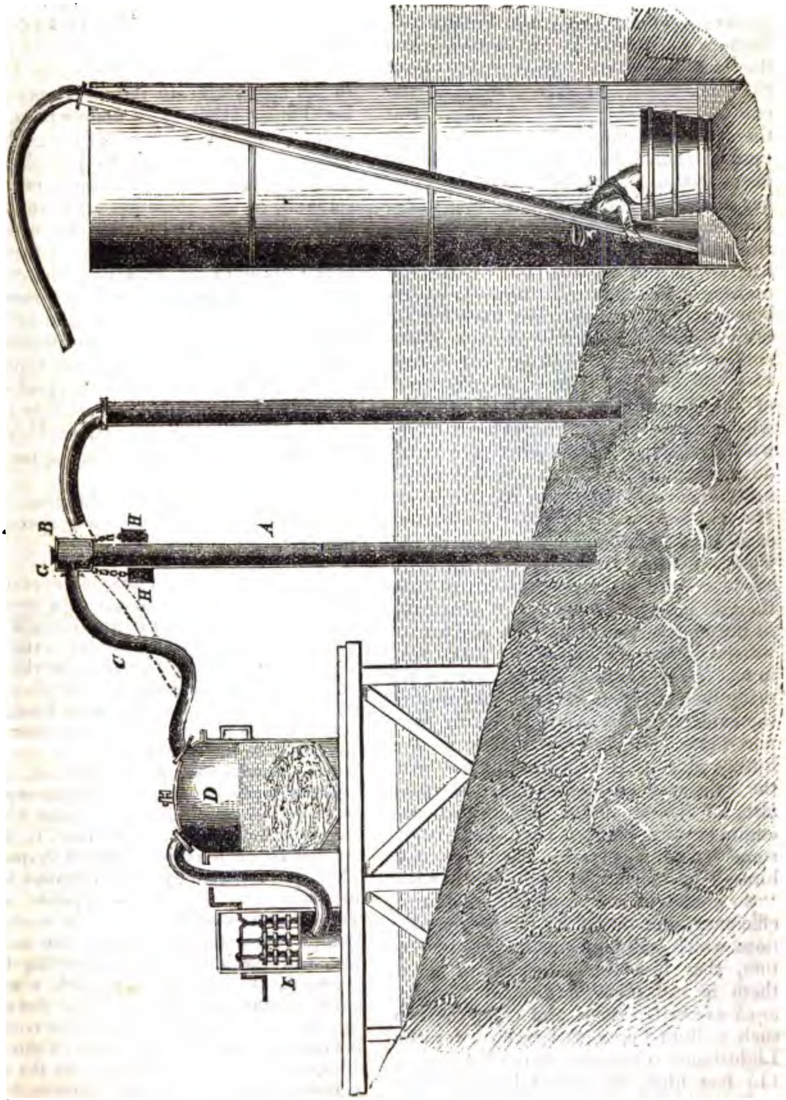
Edited by J. C. Robertson, No. 166, Fleet-street.

Fig. 1.



DR. POTTS'S PATENT IMPROVEMENTS IN HYDRAULIC ARCHITECTURE.

DR. POTTS'S PATENT IMPROVEMENTS IN HYDRAULIC ARCHITECTURE.

[Patentee, Laurence Holker Potts, M.D. Patent dated, December 5, 1843; Specification enrolled, June 5, 1844.]

ENGINEERS generally may not be pleased, perhaps, to be taught by a gentleman not of their own profession, so valuable a lesson in their art as that which forms the subject of the present patent; any more than the Judges and Bishops were wont to be pleased, when the late ingenious but eccentric Lord Stanhope boasted so often of teaching the one law, and the other divinity. But there are some, and these not the least eminent amongst them, who have not been slow to acknowledge that Dr. Potts has indeed taught them something worth knowing respecting the laying of submarine foundations,—something which they had no idea of before—and which they make no question may be turned to excellent practical account. Dr. Potts having been examined a week or two ago on the subject before the Harbour of Refuge Commission, Mr. Walker, the President of the Institution of Civil Engineers, who is a member of the Commission, with a candour and promptitude which do him infinite honour, avowed at once a most favourable opinion of the invention. He had seen *with surprise* the results of an experimental demonstration of Dr. Potts's method of sinking piles through sand—considered it very ingenious—and thought it might be tried with advantage in the construction of all piers and breakwaters not erected on hard or rocky bottoms. [The Commission not having yet made their Report, or published any of the evidence taken before them, we cannot quote Mr. Walker's precise words; but we give what we *know* to have been the substance of them.] Mr. Gordon, also, of whose ability as a light-house engineer our readers have had lately some striking proofs, has expressed himself on the subject in these terms:—"So confident am I of the economy, efficiency, and durability of the foundations which can be made by this invention, that I would undertake to adopt them in and *through any sand banks, such as the Goodwin*, and erect thereon such a light-house as I erected for the Light-house Commissioners of Jamaica, 115 feet high, by 19 feet base, or such as Her Majesty's Government employed me for, 140 feet high, by 25 feet base, for Bermuda."

The peculiarity of the mode of construction ushered into the world under these favourable auspices, consists in a singularly felicitous application of pneumatic power to the sinking of the piles necessary for the erection of hydraulic structures. Instead of using *solid* piles, and driving them down by main force, as has been hitherto the usual practice, Dr. Potts makes use of *hollow* piles, and sinks them by means of atmospheric pressure—that is to say, by pumping up from within each pile the sand, or other soft soil, of the included area, and producing a vacuum, which the pile instantly descends to occupy. Having witnessed, as Mr. Walker did, an actual trial of this mode of sinking piles, our surprise was not less than his at the ease and celerity with which the thing is accomplished. Compared with the old system of monkey driving, it has—if we may so speak—all the air of enchantment. Certainly there have not been many cleverer engineering feats than this accomplished, for many a day.

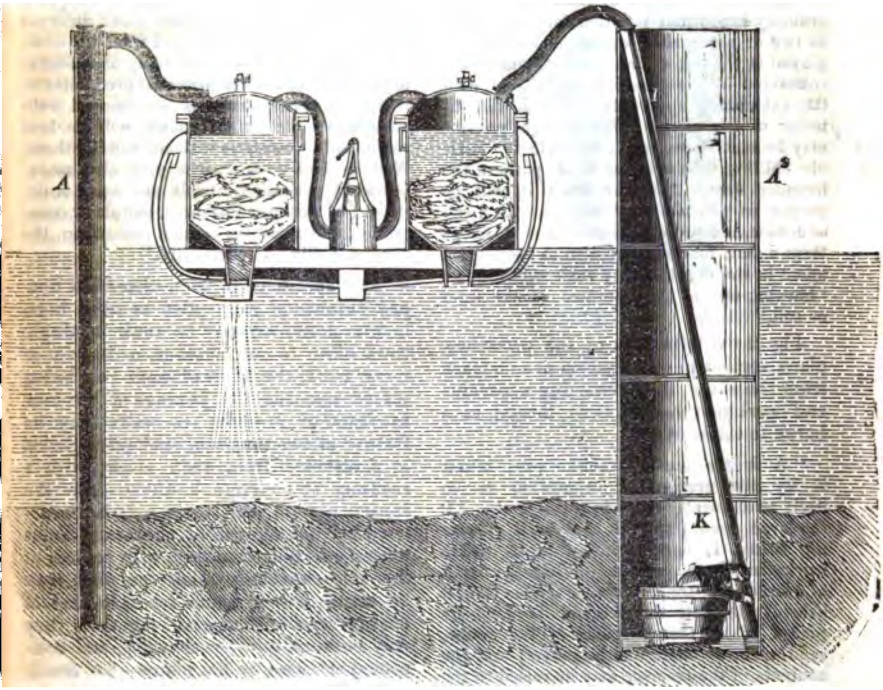
The following details of the process we extract from the inventor's specification:—

"Fig. 1 of the accompanying engravings represents the sinking of one of a series of hollow piles into a bank of sand covered with water. The pile A, which is open at the bottom, instead of being closed as in the case of a pile to be rammed, is first placed on end over the spot where it is to be fixed, and being allowed to drop through the water into the sand, the entrance of any air at the bottom is thereby effectually excluded. The top of the pile has then an air-tight cap, B, fitted upon it, and this cap is connected by means of a flexible tube, or hose, C, to a receiver D. E is a three-barrelled air-pump, which is connected by another flexible hose, to the receiver D, on the opposite side. The air-pumps being now set to work, as the air within the receiver and the hollow pile, and the intermediate connecting tube becomes exhausted or attenuated, a semi-liquid mixture of sand and water flows up into the receiver, and as often as the receiver is filled, the contents are drawn off through a trap valve F at the bottom. As the sand is thus pumped up the pile descends by its own weight and by the pressure of the atmosphere to occupy the place of the solid materials removed. The air-pump is made

three-barrelled, in order that a continuous flow of the semi-liquid mixture may be kept up, for in proportion to the amount and continuity of the power applied will be the rapidity with which the sinking of the pile is effected.

"In some places, such as quicksands and mud banks, the solid materials to be removed will be so loose, and the natural access of water so constant and abundant, that the pumping may be continued without intermission till the pipe has been sunk its entire length, or to any extent desired, but in other places it will be necessary from time to time to stir up by suitable instruments the soil of the area included within the pile, and also to pour additional supplies of water down the pipe; for this purpose there is a stuffing-box, G, in the top of the cap, by means of which cap the instruments and water may be

Fig. 2.



introduced. This cap is kept tight in its seat by the pressure of the atmosphere with the help of an interposed gasket, or leather washer. To accelerate the descent of the pile, weights, H H, may be temporarily placed upon, or attached to the top of the cap. Should any stratum be encountered of too hard a nature to be penetrated by the above means, then boring tools, such as are used in the sinking of artesian wells, may be had recourse to, to break it up; and for the sake of greater facility in working these tools, the cap may be removed altogether during the operation. If one length of pile is not sufficient, two or more lengths may be made use of by screwing or otherwise joining them endwise together."

Dr. Potts proceeds to observe that, though the preceding arrangements are "well-adapted for sinking piles of moderate diameter or section, and where the flow of water and sand, or other materials, from the exterior to the interior of the pile is free; but (that) when the sand or other material has such a consistency that the connexion between the interior and exterior is not free, or when the water has not an uninterrupted passage into the hollow pile, or when, from other causes, it may be expedient to use piles of such magnitude that the exhaustion of them would be a matter of difficulty, the process of excavation may nevertheless be

effected on precisely the same principle," in the following manner; that is to say,—

"By connecting a moveable tube of small size (which I call an elephant or operating trunk) to the exhausting apparatus, and passing it down through the then open pile or case, as represented on the right-hand side of fig. 1, but in this case the tube need not have any stuffing-box at top, as the stirring tools can be introduced when required through the open head of the pile or case. When extraordinary expedition is called for, there may be two or more such operating trunks employed at the same time, each trunk being connected by a separate flexible hose with the exhausting apparatus. And if the interior of the pile is large enough, persons may be sent down into it to guide the flexible shifting tube or tubes to all parts of the included area. In some cases it will be proper to provide the workmen with a tub or cobble, as represented in the figure to afford them a sure footing, and also to keep them afloat in the event of any rush upwards, or 'blowing up,' as it is termed of the sand or soil."

Fig. 2 exhibits both of the preceding plans applied in combination at a distance from the shore, the exhausting apparatus and workmen having been floated in a barge to the spot:—

"A is the smaller tubular pile, which is by the process of exhaustion to be itself permanently sunk into the sand. A^2, the large open pile with the small operating trunk, I, applied inside of it, and a workman, K, to guide it. When the depth of a large open-topped pile, or series of piles, exceeds 30 feet, the receiver D must be placed within that distance of the water, sand, or other matter to be raised; and the contents of the receiver may be raised to the surface by similar means to those already described, or by any of the means ordinarily employed to raise the materials in sinking pipes or shafts for wells."

The important part which the receiver D performs in both modes of operation is deserving of particular attention. Indeed, we doubt much whether, without this appendage, the apparatus could be long good for much; for were the raised sand not kept by this means quite apart from the pump-work, it would infallibly soon impede, and ultimately destroy its action.

After the piles have been sunk by the means which have been described, Dr. Potts directs that they should be filled up with "concrete grouting, cement, or some other hard material or combination of materials." But—

"Before doing so, should the soil at the bottom be of a yielding description, it may be proper to consolidate and strengthen it above and about the foot of the pile, by pouring or forcing down the hollow pile, or through a small tube carried down within the hollow pile, such chemical solutions, or pastes, as the nature of the soil and previous experiment may point out to be best adapted for the purpose. For example, by analysing samples of the soil obtained from different depths it can be ascertained what its component parts are, and according as siliceous or calcareous or other materials predominate, it will be seen what class of chemical substances, simple or compound, will be best calculated to combine with and solidify them. And in like manner, it may be also ascertained by preliminary trials on a small scale, which, of various substances, simple or compound, will effect the desired induration, the most speedily and effectually."

The specification then describes how any number of such piles as have been before described may be sunk in single rows close to one another, or in two or more rows, the piles of each row being placed opposite the joinings of the row in front of it—how sea walls may be formed of two ranges of such piles placed at a distance from each other, with a roadway of concrete between—how the construction of such works may be facilitated by making use of skeleton frames placed one above another, with orifices at the sides, through which the piles may be sunk—how in some cases, instead of having rows of piles close together, they may be sunk at intervals only, and connected sidewise by flat plates—&c. &c.

Dr. Potts concludes by describing (as supplementary to this pneumatic process) a mode of forming submarine foundations, of stones thrown loosely together, and united, *after they are under water*, into a solid mass by the administration of cement in the state of *dry* powder:—

"The cement employed may be an of those known as hydraulic cements, and be used either alone or intermixed with san stones, and shingle. And it may be delivere at the spot where it is required through continuous tube from the surface of th water, or (by means of) canisters, having bottom trap-doors for the escape of th powder."

Dr. Potts claims this mode of applyin cement to the consolidation of loo

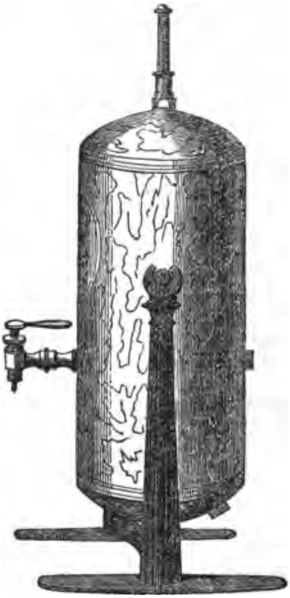
masses of stone under water as also new; and we believe it to be so. Although not so strikingly ingenious as the pneumatic pile-sinking process, it may nevertheless be of great utility in cases, such as the Plymouth breakwater, where neither piling nor regular masonry can be had recourse to.

MESSRS. KNIGHT AND SONS' AIR-TIGHT STOPPER FOR AERATED LIQUOR BOTTLES.

[Registered under the Act for the Protection of Articles of Utility.]

Messrs. Knight and Sons are the manufacturers of a "Patent portable apparatus for the production of aerated waters," of considerable note, of which it may not be out of place to say a word or two, before we proceed to describe how, by means of the present invention, these aerated waters when produced, may be bottled up, and drawn off as wanted, in any quantities, all equally brisk. The apparatus is that known as "Bakewell's patent," which has been much commended, and we think deservedly, as well for its extreme simplicity, as for its adaptability to the production of aerated liquors of all sorts, not only soda water, (of a much superior quality, however, to what is commonly sold under that name,) but every other kind of effervescing beverage, whether aperient, diuretic, tonic, antacid, lithotriptic, or peptic. The following engraving exhibits an elevation of a machine of this sort, of capacity enough to hold a gallon at a time.

Fig. 1.



The interior construction of the machine may thus be briefly described. Within the external cylinder shown in the figure, which is of strong iron, there are two distinct earthenware vessels, one above the other; in the lower one the aerating gas (carbonic acid) is generated, and in the upper is contained the water or other liquid to be aerated. The generator, or lower vessel, is separated longitudinally by a diaphragm into two parts; the lower one contains the alkali (carbonate or sesquicarbonate of soda), and the other one the acid (dilute sulphuric), by the action of which on the alkali the aerating gas is generated. As long as the machine rests in a vertical position, the alkali and acid are kept distinct, and no action takes place; but by causing the machine to vibrate on its bearings in the two standards shown in the engraving, the acid is made to drop through a small orifice in the chamber containing it, into the alkaline chamber beneath, on which a quantity of carbonic acid is instantly liberated, which is passed through a series of tubes till it enters and impregnates the water at top. The continual vibration of the machine agitating the water at the same time, enables it to absorb the gas almost as quickly as it is produced. A quarter of an hour is generally sufficient to complete the process, and impregnate the water to the extent of five atmospheres. On the top of the apparatus a pressure gauge is fixed, communicating with the water chamber; when this indicates by the rise of the mercury that a sufficient quantity of gas has been taken up, the vibrations are stopped, and the aerated liquid drawn off by the tap as wanted.

Dr. Robert Venables, who has made this apparatus and its uses the leading subject of a very able and instructive Treatise on Aerated Waters,* gives the following useful information respecting the quantities of alkali and acid required for the production of soda water of dif-

* Practical Directions for the Preparation of Aerated Waters, and the various Compounds of Carbonic Acid Gas, by Bakewell's Patent Apparatus; with observations on the pharmaceutical and therapeutical agencies, and their efficacy in the cure of some of the most important diseases of the human body, &c. 110 pp. 18mo.

ferent strengths, and also the materials necessary for the generation of other descriptions of aerated water.

"The charge of sesquicarbonate of soda for the impregnation of a gallon of water, under a pressure of five atmospheres, is about six ounces, and which for complete decomposition would require, omitting fractions, about three ounces five drachms and a half, by weight, of the common sulphuric acid. But if a highly impregnated fluid be constantly required, it is advisable to use rather more soda, say from half an ounce to an ounce. As the fluid is drawn off, the carbonic acid, relieved from the pressure, resumes a part of its elasticity, and rises above the water. This will be manifested by the fall of the pressure gauge. But if an excess of soda be used, a vibration or two will cause the gauge to rise again to its original number 'five.' The proportion of sulphuric acid for six ounces, is three ounces five drachms and a half; but it is better to have an excess of acid, by which the more perfect and complete decomposition of the sesquicarbonate of soda will be effected, and the resulting sulphate kept in solution, an advantage when cleaning out the apparatus. Seven ounces of sesquicarbonate of soda require about four ounces and one drachm by weight, consequently about six ounces would suffice.

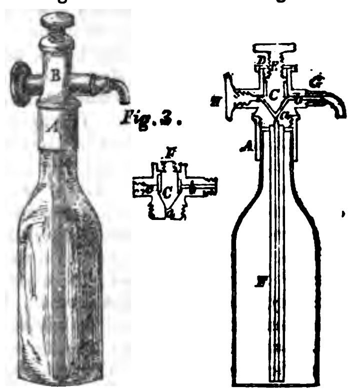
"If supercarbonated soda or magnesian water be the only beverage required, the requisite quantity of soda or magnesia may be mixed with the water to be aerated, and introduced into the aerator.

"If lemonade be the object, this may be made in the usual way, and introduced into the aerator, and subjected to the pressure of the gas. Lemonade may also be made with the crystallized citric acid; half an ounce of which, dissolved in a gallon of water, in which some dried lemon peel has been macerated, or to which the requisite flavour has been communicated by the addition of a little of the essential oil of lemons, and sweetened with sugar, will form a most agreeable and grateful lemonade, which may be aerated with or without soda, as already explained."

"When, however, it is the intention to use aerated water for several distinct and different purposes, it will be better to use simple water for the impregnation in the aerator, and expose the different matters to be carbonated to the action of the aerated water drawn off from the apparatus, in the flask, which being fitted with a valve stopple, may be detached, and the matters previously introduced into the flask, may be left exposed to the water surcharged with carbonic acid under the original pressure, for any length of time, as, from the peculiar construction, no gas can escape."

By means of the invention (the air-tight stopper) which Messrs. Knight and Sons have now registered, the aerated water, when it has been thus manufactured, may be transferred from the machine into bottles for the table; and either the whole or any portion of it may be drawn off as wanted. Fig. 1 of the following engravings is an external view of a bottle fitted with the air-tight stopper, and fig. 2 a section. A is a metal cap, which is strongly cemented to the top of the neck of the bottle. B is a three-way piece or barrel, which screws

Fig. 1. Fig. 2.



into the cap A; C is a plug, which fits into the barrel B, and as it is raised or lowered opens the three ways or passages, *a b c*. Fig. 3 shows it when closed. D is a cap to the plug C; E is a screw, with two or more threads, which passes through the cap D into the plug C, and by which, as it is turned round to the right or left, the plug is raised or lowered. F is a tube, which is fixed into the bottom of the barrel B, covering the mouth of the passage *a*, and reaches, when the barrel is screwed into its place, to the bottom of the bottle. G, an opening to the passage *b*, through which the bottle is charged with the aerated liquor, or with carbonic acid gas, to aerate a liquor not previously aerated; and through which, also, the liquor is drawn off after the bottle has been duly charged; the nozzle being taken off in the former case, and screwed on in the latter. H is a screw cap, which covers the third way, *c*, by unscrewing which the atmospheric air can be let off when required.

PROBLEMS ON STEAM POWER. BY MR. THOMAS TATE, MATHEMATICAL MASTER OF THE NORMAL SCHOOL, BATTERSEA.

[Continued from page 286.]

In order to determine the work, &c., peculiar to the transport of the train, let

T = weight of the whole train in tons.

V = the velocity in feet per minute, when the train attains its uniform, or maximum speed.

d = the diameter of the driving wheels.

r = the resistance of the friction of the rail per ton.

q = the resistance of the air, when the train, presenting a given surface, moves at V_1 velocity.

h = the elevation of the rail in every 100.

R = the total resistance to the motion of the train.

U = the units of work, due to the resistances, per minute.

22.—To determine U and H. P., when the rail is level, and the resistance of the air is neglected.

Total resistance of friction = r T lbs. Now, it has been ascertained, by experiment, that this resistance is the same, whatever may be the velocity,

∴ The work performed per minute = resistance in lbs. × the space moved over in feet per minute, that is,

$$U = r\,T\,V,$$

$$\therefore \text{H. P.} = \frac{U}{33000} = \frac{r\,T\,V}{33000}.$$

When the velocity of the train is uniform, it is evident, that the work destroyed by the resistances per minute will be exactly equal to the work performed by the engine in the same time: hence the expression for H. P. will also represent the effective horse powers of the engine.

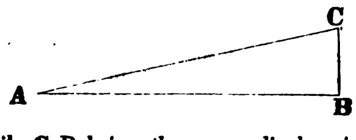
Example 26. What must be the effective horse powers of the engine in order to maintain a train of 50 tons, at a uniform speed of 20 miles per hour, assuming the resistance of friction to be 7 lbs. per ton?

Here, the velocity per minute, or

$$V = \frac{20 \times 5280}{60}, \therefore \text{H. P.} = \frac{7 \times 50 \times 20 \times 5280}{33000 \times 60} = 18{\cdot}6.$$

23.—To determine the same, as in the last problem, when the train ascends or descends an incline.

In this case the work of the engine must be equal to the work of friction, plus or minus, as the case may be, the work of gravity. In order to find the work due to gravity, let C A B (see the annexed figure) be the inclination of the



rail, C B being the perpendicular rise for the length, A C, which we shall suppose equal to the distance passed over by the train in one minute, that is, A C = V; then $C B = \frac{h\,V}{100}$; and the units of work due to gravity, in elevating the train from from A to C = weight of the train in lbs. × the perpendicular height, C B, in feet $= 2240 \times T \times \frac{h\,V}{100} = 22{\cdot}4\,h\,V\,T.$*

As the inclination of the rail is always small, the perpendicular pressure upon it will be, practically, the weight of the train, therefore, eq. (1), 22, the work due to friction per minute = r T V.

$$\therefore U = r\,T\,V \pm 22{\cdot}4\,h\,T\,V$$

$$= T\,V\,(r \pm 22{\cdot}4\,h) \ldots (1)$$

$$\therefore \text{H. P.} = \frac{T\,V}{33000}\left\{ r \pm 22{\cdot}4\,h \right\} \ldots (2),$$

where the sign of h is + or − according as the train is ascending, or descending, the incline.

Example 27. If a train of 80 tons move, steadily, at the rate of 50 miles per hour, in going down an incline of ·2 in 100, required the useful work performed upon the pistons of the engine per minute, assuming the friction of the rail to be 6·5 lbs. per ton.

* For a general demonstration of the principle here involved, see Moseley's "Mechanical Principles of Engineering," page 56.

$$\text{Here, } V = \frac{50 \times 5280}{60} = 4400,\ T = 80,\ r = 6{\cdot}5, \text{ and } h = {\cdot}2.$$

As the train is going down the gradient, the work of gravity must be taken minus in eq. (1).

$\therefore\ U = 4400 \times 80(6{\cdot}5 - 22{\cdot}4 \times {\cdot}2) = 711040.$

24. To determine the same as in the last problem, when the resistance of the air is taken into account. As a sufficient approximation to the truth, we shall suppose that the resistance of the air, to the motion of the train, varies as the square of the velocity; hence this resistance, when the velocity is $V = \frac{q\,V^2}{V}$.

$\therefore$ the units of work per minute, due to the resistance of the air $= \frac{q\,V^3}{V_1^{\,2}}$; adding this to the work due to the resistances determined in eq. (1), 23, we have,

$$U = r\,T\,V \pm 22{\cdot}4\,h\,T\,V + \frac{q\,V^3}{V_1^{\,2}}$$

$$= V\left\{ r\,T \pm 22{\cdot}4\,h\,T + \frac{q\,V^2}{V_1^{\,2}} \right\} \ldots (1),$$

whence $H.\,P. = \dfrac{U}{33000} \ldots (2).$

Example 28. A train of 50 tons moves at the rate of 20 miles per hour up an incline of 1 in 100; required the effective horse powers of the engine, necessary to do the work, supposing the resistance of friction to be 7 lbs. per ton, and the resistance of the air to be 33 lbs. to the whole train, when it moves at the rate of 10 miles per hour.

The work, per minute, due to friction $= \dfrac{50 \times 7 \times 20 \times 5280}{60} = 616000.$

$$\text{Work due to gravity} = \frac{50 \times 2240}{60} \times \frac{20 \times 5280}{100} = 1971200.$$

$$\text{Work due to the resistance of the air} = \frac{20^2}{10^2} \times 33 \times \frac{20 \times 5280}{60} = 232320.$$

$$\therefore\ H.\,P. = (616000 + 1971200 + 232320) \div 33000 = 85{\cdot}44.$$

Or we have, at once, by the formulæ (1) and (2),

$$H.\,P. = \frac{20 \times 5280}{60 \times 33000}\left\{ 7 \times 50 + 22{\cdot}4 \times 50 + 33 \times 4 \right\} = 85{\cdot}44.$$

Example 29. The weight of a train, descending an incline of $\frac{1}{2}$ in 100, is 66 tons, the friction upon the rail 8 lbs. per ton, required the effective horse powers of the engine, necessary to support a uniform speed of 20 miles per hour, the resistance of the air being the same as in the last example. By eq. (1),

$$U = \frac{20 \times 5280}{60}\left\{ 8 \times 66 - 22{\cdot}4 \times \tfrac{1}{2} \times 66 + \frac{33 \times 20^2}{10^2} \right\} = 294272, \text{ and}$$

$$\therefore\ H.\,P. = \frac{294272}{33000} = 8{\cdot}9.$$

25. To find the maximum speed of the engine.

By eq. (1), 24, the maximum velocity may, in general, be determined by the solution of a cubic equation, which, when the constants are given in numbers, may be done by Horner's method for approximating to the roots of equations; but if the resistance of the air be neglected, we readily find,

$$V = \frac{U}{T\{ r \pm 22{\cdot}4\,h \}}.$$

Example 30. If the effective horse powers of the engine be 88, what will be the maximum speed of the train, when ascending the gradient in the last example, supposing the resistance of the air to be neglected?

In this case, $U = 88 \times 33000$, and $V = \dfrac{88 \times 33000}{66(8 + 22{\cdot}4 \times \frac{1}{2})} = 2844$ feet, and the rate per hour $= \dfrac{2844 \times 60}{5280} = 32{\cdot}2$ miles.

Example 31. What will be the maximum speed of a train of 50 tons, moving on a level rail, when the horse powers of the engine $= 40$, and the resistance of friction $= 7$ lbs. per ton?

Here, $h = 0$, and $\therefore\ V = \dfrac{U}{r\,T} = \dfrac{40 \times 33000}{7 \times 50} = 3771$ feet, and, therefore, the rate per hour $= 42{\cdot}8$ miles.

26. To determine the useful load upon the pistons arising from the transport of the train with a given speed.

An inspection of eq. (1) 24 will show that the quantity within the brackets expresses the total resistance to the motion of the train; for the resistance multiplied by the space over which that resistance is moved, is equal to the units of work,

$$\therefore \ R = r\,T \pm 22{\cdot}4\,h\,T \pm \frac{q\,V^2}{V_1^{\,2}} \ldots . (1)$$

But this resistance acts upon the circumference of the driving wheels; and as the work done at the circumference of the wheels, equals the useful work done upon the pistons, we have

$$R \times d \times 3{\cdot}1416 = 2\,l \times L_1 \times 2\,K;$$

whence, by solving this equation for L_1,

$$L_1 = \frac{{\cdot}7854\,d\,R}{l\,K}$$

and eliminating R, by eq. (1), we have,

$$L_1 = \frac{{\cdot}7854\,d}{l\,K}\left\{r\,T \pm 22{\cdot}4\,h\,T + \frac{q\,V^2}{V_1^{\,2}}\right\} \ldots (2)$$

Example 32. A train of 100 tons moves steadily at the rate of 20 miles per hour, upon a level rail; the resistance of friction = 7 lbs. per ton; the resistance of the atmosphere = 33 lbs., when the train moves at the rate of 10 miles per hour; the diameter of the driving wheels = 5 ft.; the area of each piston = 110 sq. inches; and the length of the effective stroke = $\frac{4}{3}$ feet; required the useful load upon the pistons, or the pressure upon each inch of the pistons, arising from the transport of the train.

Here, $h = o$, and then,

$$L_1 = \frac{{\cdot}7854 \times 5}{\frac{4}{3} \times 110}\left\{7 \times 100 + \frac{33 \times 20^2}{10^2}\right\} = 22{\cdot}27 \text{ lbs.}$$

27. Given the velocity of the train to determine the number of strokes of each piston.

Whilst the driving wheels make one revolution, the piston makes two single strokes. Now, the number of revolutions of the wheel in one minute,

$$= \frac{\text{velo. train per min.}}{\text{circum. wheel}} = \frac{V}{3{\cdot}1416 \times d};$$

$$\therefore N = \frac{2\,V}{3{\cdot}1416 \times d}.$$

Example 33. Required the number of strokes of the piston in the last example.

$$\text{Here,} \quad V = \frac{20 \times 5280}{60} = 1760; \text{ and } \therefore N = \frac{2 \times 1760}{3{\cdot}1416 \times 5} = 224$$

28. To determine the velocity of the train, when the effective evaporation of the boiler is given.

By eq. (2) 26, L_1 is found; then 1, 21, gives

$$P = F + L_1\,(1 + f) + p + g$$

And putting 2 K for K, in eq. (1) 20, we have

$$N = S\left(\frac{n}{P} + m\right) + \frac{2\,K\,(l + c)}{144} \ldots (1)$$

where $l + c$ is expressed in units of feet.

$$\text{Finally, from 27,} \quad V = \frac{3{\cdot}1416\,d\,N}{2} = \frac{113{\cdot}097 \times d}{K\,(l + c)} \times S\left(\frac{n}{P} + m\right) \ldots (2)$$

by substituting the value of N, determined in eq. (1). Here, it may be useful to observe, that the expression $S\left(\frac{n}{P} + m\right)$ is the volume of the steam at P pressure. The values of L_1 and P will be approximated to, by the method explained at 1, 21.

Example 34. Required the maximum velocity of a train, when S = ·8 c. ft., (which may be taken as an average evaporation, corresponding to a speed from 20 to 25 miles) $K = 100$; $l = \frac{4}{3}$; $c = o$; $F = {\cdot}5$; $p = 14{\cdot}7$; $f = \frac{1}{7}$; $g_1 = 1{\cdot}75$; $d = 5$; $q = 50$; $r = 8$; and $T = 60$.

As a first approximation, let us suppose that the rate is 25 miles per hour, then,

$$L_1 = \frac{{\cdot}7854 \times 5}{\frac{4}{3} \times 100}\left\{8 \times 60 + 50 \times \frac{25^2}{10^2}\right\} = 23{\cdot}29 \text{ lbs.}$$

$$P = {\cdot}5 + 23{\cdot}29\,(1 + \tfrac{1}{7}) + 14{\cdot}7 + 4{\cdot}3 = 46 \text{ lbs.}$$

But by experimental tables, steam at 46 lbs. pressure is 596 times the volume of the water from which it is raised.

$$\therefore \text{vol. steam expended per min.} = 596 \times {\cdot}8 = 476{\cdot}8$$

$$\text{Then, by eq. (2), } V = \frac{113{\cdot}097 \times 5}{\frac{4}{3} \times 100} \times 476{\cdot}8 = 2022 \text{ feet.}$$

Or the rate per hour = 23 miles nearly. Now, the velocity was assumed = 25 miles per hour, therefore, the true volocity must lie between 23 and 25; we shall, therefore, now assume the velocity to be 24 miles per hour, going over the whole calculation, with this assumption, we find, the velocity per hour = 23½ miles nearly; so that the true velocity must be between 23½ and 24. Proceeding in this manner, the velocity may be determined to any degree of exactness.

29. To determine the evaporation of the boiler, so as to support a given speed.

By solving eq. (2), 28, for S, we have

$$S = \frac{V\,K\,(l + c)}{113{\cdot}097\,d\left(\frac{n}{P} + m\right)};$$

where, $\frac{n}{P} + m$, is the volume of the steam, the water being unity.

Example 35. In examples 32 and 33, let $c = \frac{\cdot 8}{12}$, $F = 1$, $f = \frac{1}{7}$, $p = 15$, $g_1 = 1{\cdot}75$, required the effective evaporation of the boiler per minute.

By example 32, $L_1 = 22{\cdot}27$.

$$\therefore P = 1 + (1 + \tfrac{1}{7})22{\cdot}27 + 15 + \frac{1{\cdot}75 \times 20}{10} = 45 \text{ lbs.}$$

By experimental tables, steam at 45 lbs. pressure is 608 times the volume of the water from which it is raised, therefore, by the formula,

$$S = \frac{1760 \times 110 \times \frac{16{\cdot}8}{12}}{113{\cdot}097 \times 5 \times 608} = {\cdot}787 \text{ cubic feet.}$$

30. To determine the weight of the train, so as to move with a given speed, the useful work of the engine being given.

By solving eq. (1), 24, for T, we have,

$$T = \left\{\frac{U}{V} - \frac{q\,V^2}{V_1^{\,2}}\right\} \div (r \pm 22{\cdot}4\,h).$$

Example 36. What must be the weight of the train, so that an engine of 22 effective horse powers, may sustain a speed of 33 miles per hour, down an incline of ¼ in 100, the friction being 8 lbs. per ton?

$$\text{Here, } U = 22 \times 33000\,;\ V = \frac{33 \times 5280}{60} = 33 \times 88,\ h = \tfrac{1}{4}\,;\ r = 8\,;\ \text{and } q = 0\,;$$

$$\therefore T = \frac{22 \times 33000}{33 \times 88\left\{8 - 22{\cdot}4 \times \tfrac{1}{4}\right\}} = 104{\cdot}1 \text{ tons.}$$

31. To determine the weight of the train, when the useful load of the engine is given.

By solving eq. (2), 26, for T, we find,

$$T = \left\{\frac{l\,K\,L_1}{{\cdot}7854\,d} - \frac{q\,V^2}{V_1^{\,2}}\right\} \div (r \pm 22{\cdot}4\,h).$$

Example 37. The useful load of the engine = 30 lbs.; what must be the weight of the train, moving up an incline of 2 in 100, when $r = 7$, $d = 5$, $K = 110$, $l = \frac{4}{3}$, and $q = 0$.

$$\text{Here, } T = \frac{\frac{4}{3} \times 110 \times 30}{{\cdot}7854 \times 5(7 + 22{\cdot}4 \times 2} = 21{\cdot}6 \text{ ton.}$$

32. To determine the inclination of the rail, so that the train may move down the incline, by the force of gravity, with a given speed.

When the work of the steam is nothing, U, in eq. (1), 24, also becomes nothing, in this case, therefore, the expression within the vinculum equals nothing, that is,

$$r\,T - 22{\cdot}4\,h\,T + \frac{q\,V^2}{V_1^{\,2}} = 0,$$

from which equation, we obtain,

$$h = \frac{1}{22{\cdot}4\,T}\left\{r\,T + \frac{q\,V^2}{V_1^{\,2}}\right\}\ldots(1).$$

If the resistance of the air be neglected,

then $h = \frac{r}{22 \cdot 4} \ldots (2)$.

Example 38. What must be the inclination of the rail, so that the train may just move down the incline, when the friction is 8 lbs. per ton?

By eq. (2), $h = \frac{8}{22 \cdot 4} = \cdot 357$.

Example 39. What must be the inclination of the rail, so as to support a uniform speed of 20 miles per hour, by the force of gravity, the weight of the train being 100 tons, the friction the same as in the last example, and the resistance of air the same as in example 29.

$$\text{By eq. (1), } h = \frac{1}{22 \cdot 4 \times 100}(8 \times 100 + 33 \times 4) = \cdot 416.$$

Example 40. What must be the total elevation of the rail, in the last example, to carry the train a distance of $2\frac{1}{2}$ miles?

By the last example, for 100 miles the rail would rise ·416 miles; then as $2\frac{1}{2}$ are the $\frac{1}{40}$ of 100, we find, the elevation for $2\frac{1}{2}$ miles $= \frac{\cdot 416 \times 5280}{40} = 54 \cdot 9$ feet.

Observation.— These investigations, seem to suggest, that it is by no means impracticable to construct a railway, where gravity alone is the motive force.

33. To determine the velocity of the train, after the steam is turned off.

Let V be the velocity in feet per second, when the steam is turned off; and V_1 the velocity after the train has moved over D feet; then by 7, page 101.

The work accumulated in the train

$$= \frac{V^2 \times T \times 2240}{2g}$$

Similarly, the work remaining in the train, after having passed over D feet

$$= \frac{V_1^2 \times T \times 2240}{2g}.$$

The work destroyed by friction in moving over D feet $= D\,T\,(r \pm 22 \cdot 4\,h)$. Now, the work remaining in the train, must be equal to the work in the train at first, minus the work destroyed by the resistances.

$$\therefore \frac{V_1^2 \times T \times 2240}{2g} = \frac{V^2 \times T \times 2240}{2g} - D\,T\,(r \pm 22 \cdot 4\,h),$$

$$\therefore V_1^2 = V^2 - D \times 2g \left\{\frac{r \pm 22 \cdot 4\,h}{2240}\right\}.$$

For the sake of abbreviation, put e for $\frac{r \pm 22 \cdot 4\,h}{2240}$; then,

$$V_1^2 = V^2 - D \times 2\,ge \ldots (1),$$

$$\therefore V_1 = (V^2 - D \times 2\,ge)^{\frac{1}{2}} \ldots (2).$$

If the train descend the incline, by the force of gravity alone, then $V = 0$, and then,

$$V_1 = \left\{D \times 2g\left(\frac{22 \cdot 4\,h - r}{2240}\right)\right\}^{\frac{1}{2}} \ldots (3).$$

Example 41. If a train descend an incline of ·4 in 100, by the force of gravity, what will be its velocity, after moving over the space of 2,000 feet, the friction being 8 lbs. per ton?

$$\text{Here, taking } g = 32, \text{ by eq. (3), } V_1 = \left\{\frac{2000 \times 2 \times 32}{2240}(22 \cdot 4 \times \cdot 4 - 8)\right\}^{\frac{1}{2}} = 7 \cdot 4 \text{ feet},$$

and the rate per hour = 5 miles nearly.

34. To determine the distance at which the train, in the last problem, will have a given velocity.

By solving eq. (1), 33, for D, we have,

$$D = \frac{V^2 - V_1^2}{2ge} \ldots (1).$$

If $V_1 = 0$, that is, if the train come to a state of rest, then this equation simply becomes, $D = \frac{V^2}{2ge} \ldots (2)$, which is an expression for the whole distance, over which the train will move, after the steam is turned off.

Example 42. At what distance, from the point at which the steam is turned off, will the engine, in example 26, have a velocity of 10 miles per hour?

In this case, $r = 7$, $h = 0$, $v = \frac{88}{3}$, and $v_1 = \frac{88}{6}$, then by eq. (1),

$$D = \left\{\left(\frac{88}{3}\right)^2 - \frac{1}{4}\left(\frac{88}{3}\right)^2\right\} \div \frac{2 \times 32 \times 7}{2240} = 3226 \text{ feet} = \cdot 61 \text{ miles}.$$

Example 43. A train moves, uniformly, at the rate of 30 miles per hour, up an incline of ·5 in 100, how far will the train move, after the steam is cut off, taking the friction at 8 lbs. per ton?

$$\text{Here, } v = \frac{30 \times 5280}{60 \times 60} = 44, \text{ and } e = \frac{8 + 22{\cdot}4 \times {\cdot}5}{2240}, \text{ then by eq. (2),}$$

$$D = \frac{2240 \times 44^2}{64(8 + 22{\cdot}4 \times {\cdot}5} = 3529 \text{ feet.}$$

35. To determine the time in which the train will move any given distance, after the steam is turned off.

Resuming eq. (1), 33, we have, by division and transposition,

$$\frac{V^2}{2ge} - D = \frac{V_1^2}{2ge}.$$

But by eq. (2), 34, $\frac{V^2}{2ge}$, is the whole distance through which the train will move, therefore the right hand member of the equation, just found, will be the distance of the train, estimated from the point where it will stop; putting, then, S_1, for this distance, we have, $S_1 = \frac{V_1^2}{2ge}$.

Comparing this with the equation $V = \frac{V^2}{2g}$, expressing the relation between the space and velocity of a falling body, we infer that the train, after the steam is turned off, is acted upon by a constantly retarding force, and that this force $= ge$.

It will now be an easy matter to determine all the circumstances attending the motion, for we have generally,

$$V_{,} = t_{,} \times g\,e; \therefore t_{,} = \frac{V_{,}}{g\,e}$$

$$s_{,} = t_{,}^2 \times \frac{g\,e}{2}; \therefore t_{,} = \sqrt{\frac{2\,s_{,}}{g\,e}}$$

where $s_{,}$ and $t_{,}$ are referred to the point at which the train stops.

When $V_{,} = V$, then $t = \frac{V}{g\,e}$ . . . (1),

which expresses the time in which the train will come to a state of rest.

If, therefore, $t_{,,}$ be the time, estimated from the moment at which the steam is turned off, corresponding to the velocity $V_{,}$, then

$$t_{,,} = t - t_{,} = \frac{V - V_{,}}{g\,e} \; . \; . \; . \; . \; (2)$$

Example 44. In what time will the train in Example 43 lose its motion?

Here $v = 44$, and $e = {\cdot}00857$; then, by eq. (1)

$$t = \frac{44}{32 \times {\cdot}00857} = 160 \text{ seconds} = 2{\cdot}6 \text{ min.}$$

Example 45. At what time after the steam is turned off will the train in the last example have a velocity of 7½ miles?

Here $V_{,} = 11$, and the other elements being the same as in the last example, we have, by eq. (2)

$$t_{,,} = \frac{44 - 11}{32 \times {\cdot}00857} = 121 \text{ seconds.}$$

(*To be continued.*)

NEW STEAMERS—THE "METEOR" AND "PRINCESS MARY."

Sir,—Two new steamers of great speed have appeared this season, the *Meteor* and the *Princess Mary*. The former is a beautiful boat; she is as slight, both in form and construction, as it is possible for a boat to be, even to navigate the smooth waters of the Thames. She is worked with rather high-pressure, and would have most probably attained a greater speed if she had not unfortunately been fitted with beam-engines. She has had several trials with the *Prince of Wales* and *Isle of Thanet*, which she has beaten, and with the *Sapphire* which she has nearly equalled. The latter (the *Princess Mary*) I have not myself seen; but, according to the account in your last Number, she has most of the qualities essential in swift boats. She has beaten the *Prince of Wales* and *Isle of Thanet*, but I think by less than the *Meteor* would have beaten them in the same distance.

The additional radiation in atmospheric engines arises from three causes, the increased size of the cylinder, the exposure of the piston, and the exposure of the inner surface of the cylinder for half the stroke; it is the two former, and not, as "S." supposes, the latter, which I think can be lessened by felting. I admit that this would at the same time increase the comparative loss; but the amount being small in either case, (for Tredgold's calculation is evidently excessive,) that can be of no practical consequence. I believe "S." now allows the increase of friction, while a slight increase of radiation has never been denied by,

Sir, &c.

CURVE.

THE PATENT IRON TUBE CASE.

Court of Exchequer, June 22 and 24.

Before Baron Alderson and a Special Jury.

Russell v. *Ledsam and others.*

The plaintiff's case in this action occupied four days of the sittings after Michaelmas term last, and was brought to a sudden termination by the indisposition of a juryman.

The continuation of the trial was resumed on the present occasion by the defendants, who called several scientific witnesses, who proved the defendants' practice to be the welding of iron tubes on a mandril. The plaintiff, it is alleged, does not and cannot use a mandril; neither can he, by his process, make the kind of tube which the defendants manufacture for the construction of marine and locomotive boilers.

Mr. Baron Alderson summed up the case to the Jury in the following terms:—

"This case," said the learned Judge, "once came before the Court of Exchequer in Russell *v.* Cowley, and the Court there was very anxious, as all Courts ought to be, if they can by any reasonable and fair means, to support useful and valuable inventions, and not to turn them aside lightly by any matter that is not the essence of the thing. In modern times the Courts have been more liberal than they were in ancient times, and I believe ours has been considered to be by far the wisest course of the two. Let us see what the Court with some difficulty extracted, as being what they considered to be the principle and the real merits of the invention of Whitehouse, whose invention we are now taking into consideration. The specification is this. He describes the mode of doing it, and he says by heating it to the point of fusion, and passing the heated iron through a pair of dies or swages, the iron becomes united, and a weld is performed, and the tube is drawn through in a welded state. Now it seems the Court, having taken a good deal of pains to consider the matter, came to this conclusion—the notion which the Court of Exchequer had at the time when this case came before them, and when they supported the patent—was that it claimed to make the pipes without beating, or pressure upon any hard or internal surface; that is to say, claimed to make pipes by beating or pressure without an internal mandril, and nobody had made pipes without an internal mandril before; and if this was a specification for making without a mandril, then so far as the case was before the Court, it was clearly a new and useful invention. The only evidence in that case was James and Jones's specification; and when you come to look at the specification of James and Jones you find James and Jones universally speak of a mandril being used in their invention. The Court of Exchequer say, James and Jones's patent is, in some respects, like yours, because you draw it through dies, and they pass it through rollers—and there is no practical difference; but, remember, they pass it through rollers, and knock it with a hammer, with a mandril inside, and you pass it through a die, without a mandril inside—and that is the distinction between you. That was the decision, gentlemen, upon which Russell and Cowley depended; and that I apprehend to be the true title of the patent, according to the view of the Court of Exchequer. I am bound to act on that now; and you are bound to take the law from the Court of Exchequer—and are bound to take that as the reasonable construction of the Court of Exchequer. Now, in the present case, the defendants put in, not only James and Jones's patent, which claims the making of tubes with a mandril inside—but they put in the patent of James Russell, who took out a patent for welding, by means of knocking with a circular hammer—the top being hollowed out into a groove, and the anvil being hollowed out into a similar groove—which together form the tube—the same thing in substance as pressure, and is equivalent to a roller with grooves. Then we have James Russell's, for making with or without a mandril, and taken out a year or a year and a half before Whitehouse's. Then, if that be so, and the Court of Exchequer are right in saying the real value of the invention of Whitehouse was, by welding by circular pressure, without a mandril—and if you think that in point of fact hammering, according to James Russell's patent, is circular pressure or circular impact, then there was an invention for welding a thing by circular impact taken out *before* the patent of Whitehouse, and therefore Whitehouse's patent was not new on the principle on which the Court of Exchequer sustained it, namely,—it being a mode for the first time of welding barrels and tubes without internal pressure, arising from a mandril inside.

"Now, if the patent of Whitehouse is for drawing it through a die, as distinguished from the mere hammering or passing it through rollers, if advantage is derived from the circumstance that it is drawn from a fixed point by the draw-bench, and so stretches the iron in that way, and brings it through the die—if that is the real merit of the invention, and the Court of Exchequer were wrong, then ask yourselves this questionw—hich is a difficult question for the plaintiff to get over)—how can you say that rollers are an infringement on that? for if the principle depends on drawing, how do rollers draw? If it is the scrubbing of the tube on the edge of the die, is there anything equivalent to that when they are passed through rollers without a mandril inside—because we must now exclude the internal mandril? If we are to exclude that against the defendants, for the purpose of making an infringement, we must exclude it for them by saying that when doing it without a mandril it is mere circular pressure. If it passes through rollers, it is the motion—it is the tube going on with the roller itself, sticking to the point, and as the roller turns round, it moves it; because as the roller turns round, it is not dragged from any portion of the roller at all, but it goes with the roller without any drawing at all; and therefore, if the essence of the plaintiff's patent be for drawing, I must say, I should recommend you to take very seriously into your consideration whether you should not find a verdict of not guilty for the defendants?

Mr. Jervis.—Your Lordship will find that Cowley and Dixon, the defendants in Russell *v.* Cowley, drew by rollers without a mandril, and they held that to be an infringement.

Mr. Baron Alderson.—No doubt, because the Court did not hold it drawing.

Mr. Jervis.—It was drawn by the rollers.

Mr. Baron Alderson.—The Court held that all pressure without an internal mandril was the principle of the invention. Therefore, gentlemen, the Court said, whether drawn or not, it is an infringement; but if they are to shift the matter, and make the *drawing* the invention, it is no infringement. The plaintiff is on the horns of that dilemma. You had better take it in the way in which the Court of Exchequer viewed it, and say whether or not you are satisfied that the circular hammering of James Russell is in truth the same thing as circular pressure without internal support. If you are of that opinion, then I should recommend you to find the second and third issues for the defendants. The question is, whether, if the Court of Exchequer are right, James Russell's is not the same principle.

The Associate.—For whom do you find?

The Foreman.—For the plaintiff on all the issues.

Mr. Baron Alderson.—Damages 40*s.* We take 40*s.* damages, gentlemen, to avoid any question under Lord Denman's Act.

[The verdict of the Jury being at variance with the Judge's charge, the defendants intend, we understand, to move for a new trial next term.]

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65. FROM 21ST MAY TO 25TH JUNE, 1844.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
May 21	188	Walter Mabon	Ardwick Foundry, Manchester	Lubricator.
22	189	John and Edward Butler.	Walsall	Cigar case.
28	190	Thomas Wolferstan	Salisbury	Safety boiler tap.
28	191	Henry Chany	Clifton-street, Finsbury-square	Shifting lever ball cock.
28	192	H. and T. Merry	Birmingham	Candlestick and shade combined.
June 6	193	George Knight	Foster-lane, London	Air-tight stopper for aerated liquor bottles.
6	194	Ralph Wilson	30, Edward-street, Portman-sq.	Coat or garment, designed for the preservation of life against drowning.
6	195	Francis Baildon Oerton	Walsall, Staffordshire	Harness tug.
11	196	Ebenezer Spencer	230, Shoreditch	Machine for cutting splints.
11	197	Isaac Suggitt	Howden, County of York	Lamp for burning spirit.
11	198	William Sangster	Regent-street, Westminster	Lunette parasol or umbrella.
12	199	Hargrave, Brothers	Wood-street, Cheapside	Improved stick or runner for umbrellas or parasols.
12	200	William Crosskill	Beverley	Pig trough.
14	201	Richard Hornsby	Spittlegate, near Grantham, Lincolnshire	Feed apparatus for agricultural machines.
14	202	James Wilson	37, Walbrook, London	Apparatus for shaping hat linings.
15	203	Webster and Johnson	Sheffield, Yorkshire	Improved pit and frame saw.
17	204	Fletcher and Woolley	180, High Holborn, in the county of Middlesex	Shape and configuration of lamps with flat wicks, to burn camphine, naphtha, reseneine, oils, and such like substances, with an improved method of raising the fluid up to the wick, and which may be applied to other purposes, such as inkstands, &c.
25	205	Frederick Fovaux Weiss.	Strand	Improved surgical syringe.
25	206	John Warr	Canal-street, Derby	Improved cooking apparatus.

NEW WORKS CONNECTED WITH THE ARTS AND SCIENCES PUBLISHED IN JUNE.

THE SENATE HOUSE PROBLEMS for 1844, with Solutions. By Matthew O'Brien, M.A., Caius College, Robert Leslie Ellis, M.A., Trinity College, Cambridge, Moderators. 4s. 6d.

A TREATISE on BAR-HARBOURS. By W. B. Prichard, Esq., C.E., &c. Comprising Classification of Harbours, and Value of their Improvement to Society—Theory of Bars, and True Cause of their Origin—Travelling of Shingle, &c. Illustrated with engraved Plans and Wood-cuts, bound in cloth. 1*l*.

ELEMENTARY INSTRUCTION in CHEMICAL ANALYSIS, as practised in the Laboratory of Giessen. By Dr. C. Remigius Fresenius. With a preface by Professor Liebig. Edited by Lloyd Bullock, late Student at Giessen. 9s.

REPORT of the THIRTEENTH MEETING of the BRITISH ASSOCIATION for the ADVANCEMENT of SCIENCE, held at Cork, in August 1843. With three plates. 12s.

ACTONIAN PRIZE ESSAY.—CHEMISTRY, as exemplifying the Wisdom and Beneficence of God. By George Fownes, Ph. D., Lecturer on Chemistry in the Middlesex Hospital Medical School. 6s.

REPORT on the ATMOSPHERIC RAILWAY SYSTEM. By Robert Stephenson, Esq. With twenty-seven plates. 7s.

LECTURES on AGRICULTURAL CHEMISTRY and GEOLOGY. By James F. W. Johnston, M.A., F.R.SS. L. and E., &c. &c. Chemist to the Agricultural Chemistry Association of Scotland, and Reader in Chemistry and Mineralogy in the University of Durham. With an appendix, containing Suggestions for Experiments in Practical Agriculture. 1*l*. 4s.

DESCRIPTION of the BAR-AND-FRAME HIVE, invented by W. Augustus Munn, Esq., with an Abstract of Wildman's "Complete Guide for the Management of Bees throughout the Year." 2s. 6d.

ENCYCLOPÆDIA of DOMESTIC ECONOMY. Comprising such subjects as are most immediately connected with Housekeeping. By Thos. Webster, F.G.S. &c.; assisted by the late Mrs. Parkes, Author of "Domestic Duties." One thick volume, 8vo., with nearly 1000 woodcuts, uniform with Messrs. Longman and Co.'s Series of "One-volume Encyclopædias and Dictionaries."

THE INDUSTRIAL RESOURCES of IRELAND. By Robert Kane, M.D., Secretary to the Council of the Royal Irish Academy, Professor of Natural Philosophy to the Royal Dublin Society, and of Chemistry to the Apothecaries' Hall of Ireland. 7s.

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Periodicals.

The London, Edinburgh, and Dublin Philosophical Magazine. No. 158. 2s. 6d.

The Edinburgh New Philosophical Journal. No. 76. 7s. 6d.

The Civil Engineer and Architect's Journal. No. 82. 1s. 6d.

The London Journal (Newton's). No. 150. 2s. 6d.

The Repertory of Patent Inventions. Enlarged Series. No. 20. 3s.

The Glasgow Practical Mechanics' and Engineers' Magazine. Part 33. 8d.

The Artizan. No. XVII. 1s.

The Builder. Part XV. 8d.

The Nautical Magazine. No. 17. Enlarged Series. 1s.

Pharmaceutical Journal and Transactions (Bell). 1s.

The London Polytechnic Magazine. Edited by Thomas Stone, M.D. No. 6.

Annals and Magazine of Natural History, including Zoology, Botany, and Geology. By Sir William Jardine, Bart., P. J. Selby, Esq., Dr. Johnson, &c. No. 136. 2s. 6d.

The Zoologist. No. XXXVIII.

The Phytologist; a Popular Botanical Journal, on the plan of "The Zoologist." No. III.

LIST OF ENGLISH PATENTS GRANTED BETWEEN MAY 25, AND JUNE 26, 1844.

William Augustus Guy, of Bloomsbury-square, bachelor of medicine, for certain improvements in ventilation. May 25; six months.

Charles Low, of Robinson's-row, Kingsland, for certain improvements in the making or manufacturing of iron and steel. May 25; six months.

Charles Anthony Deane, of Poplar, for improvements in the constructing, propelling and steering vessels. May 30; six months.

Robert Hazard, of Clifton, near Bristol, confectioner, for improvements in baths. May 30; six months.

John Lee, of Newcastle-upon-Tyne, Esq., for improvements in obtaining products from sulphurets and other compounds containing sulphur. May 30; six months.

James Fenton, of Manchester, engineer, for an improved combination or alloy, or improved combinations or alloys of metals applicable to various purposes, for which brass and copper are usually employed in the construction of machinery. May 30; six months.

Walter Noak, of West Bromwich, Stafford, colliery agent, and John Noak, of the same place, engineer, for improvements in the manufacture of salt, and in the apparatus to be used therein. June 1; six months.

Edward Massey, of King-street, Clerkenwell, watchmaker, for improvements in apparatus for ascertaining the rate at which vessels are passing through the water, also applicable in ascertaining the rate at which streams or currents are running. June 1; six months.

James Murdoch, of Staple Inn, Middlesex, mechanical draftsman, for certain improvements in the manufacture of gas, and in the apparatus employed therein. (Being a communication.) June 4; six months.

William Henry Phillips, of Bloomsbury-square, Middlesex, engineer, for certain improvements in the means and apparatus for subduing and extinguishing fire and saving life and property, and in obtaining and applying motive power, and improvements in propelling. June 4; six months.

George Chapman, of Claremont-terrace, Strangeways, Manchester, engineer, for certain improvements in steam engines. June 4; six months.

Henry Boden, of Derby, lace-manufacturer, for an improvement in the manufacture of bobbin net, or twist lace. June 4; six months.

Joseph Cowen, of Blaydon Burn, near Newcastle-upon-Tyne, merchant, for certain improvements in making retorts for generating gas for illumination. June 4; six months.

William Ward, of Leicester, hosier, and David Winfield Grocock, of the same place, framesmith, for improvements in machinery for manufacturing framework, knitted or netted work. June 4; six months.

William Elliott, of Birmingham, button manufacturer, for improvements in the manufacture of covered buttons. June 4; six months.

Paul Griffiths, of Holywell, in the county of Flint, millwright, for improvements in washing the products evolved from furnaces. June 4; six months.

Joseph Woods, of Bucklersbury, London, civil engineer, for improvements in producing designs and copies, and in multiplying impressions, either of printed or written surfaces. (Being a communication.) June 6; six months.

David Cheetham, of Rochdale, Lancaster, cotton spinner, and Edward Briggs of the same place, hat manufacturer, for certain improvements in the manufacture of hats, and in machinery or apparatus connected with such or similar manufacture. June 6; six months.

William Higham, of Nottyash, near Liverpool, and David Bellhouse, of Liverpool, aforesaid, merchant, for improved constructions of boilers for evaporating saline and other solutions, for the purposes of crystallization. June 5; six months.

Edmund Morewood, of Thornbridge, Derby, merchant, and George Rogers, of Stearndale, same county, gent., for improvements in coating iron with other metals. June 8; six months.

Elijah Galloway, of Nelson-square, Blackfriars'-road, Surrey, for machinery, for connecting axles or shafts, whereby, when in motion they revolve at different relative velocities. June 12; six months.

Thomas Farmer, of Birmingham, manufacturer, for certain improvements in the ornamenting of papier mache, and in manufacturing and ornamenting japanned goods generally. June 12; six months.

George Kent, of Constitution-row, Gray's-Inn Road, blind-maker, for improvements in machinery for cleaning, polishing, and sharpening knives, forks and other articles. June 12; six months.

Moses Poole, of Serle-street, Middlesex, Gent., for improvements in wheels and axles. (Being a communication.) June 12; six months.

John Swindells, of Manchester, manufacturing chemist, for several improvements in the preparation of various substances for the purpose of dyeing and producing colour, also improvements in the application and use of several chemical compounds for the purpose of dyeing and producing colour not hitherto made use of. June 12; six months.

Alexander Simon Wilcott, of Manchester, machinist, for improvements in roving and spinning cotton, wool, and other fibrous substances. June 18; six months.

Charles William Graham, of King's-Arms-Yard, London, merchant, for improvements in manufacturing pathological, anatomical, zoological, geological, botanical and mineralogical representations in relief, and in arranging them for use. June 18; six months.

George Wilson, of Saint Martin's-court, Saint Martin's-lane, stationer, for improvements in the cutting of paper for the manufacture of envelopes, and for other purposes. June 19; six months.

William Sutcliffe, of Bradford, York, manufacturer, for improvements in preparing, dyeing, sizing or dressing, drying and winding yarns and manufactured fabrics of wool, flax, cotton, silk and other fibrous materials. June 19; six months.

Pierre Armand Lecomte de Fontainemoreau, of Skinner's-place, Size-lane, London, for a new mode of locomotion applicable to railroad and other ways. (Being a communication.) June 21; six months.

Thomas Lever Rushton, of Bolton-le-Moors, Lancaster, iron manufacturer, for certain improvements in the manufacture of iron. June 21; six months.

Christopher Phipps, of River, near Dover, paper manufacturer, for an improvement or improvements in the manufacturing of paper, and in marking,

writing, and other papers, or in the machinery employed for those purposes. (Being partly a communication.) June 21; six months.

James Shaw, of Sheffield, manufacturer of Britannia metal articles, for improvements in the manufacture of metal dish covers and metal dishes. June 24; six months.

Rees Davis, of Yetradgunlais, Brecon, gent., for improvements in the manufacture of iron. June 24; six months.

William Worby, of Ipswich, for improvements in the manufacture of bricks, tiles and other articles from plastic materials. June 24; six months.

Charles Maurice Elizee Sautter, of Austin Friars, gent., for improvements in pianofortes. June 26; six months.

LIST OF PATENTS GRANTED FOR SCOTLAND FROM THE 22ND MAY TO THE 22ND OF JUNE, 1844.

Frederick William Etheredge, of Furnival's Inn, Middlesex, gentleman, for improvements in the manufacture of bricks, tiles and tubes. Sealed, May 27.

William Basford, of Burslem, Stafford, brick and tile manufacturer, for certain improvements in the mode of manufacturing bricks, tiles, quarries and certain other articles made or composed of clay and brick earth, and of burning and firing the same, and certain articles of pottery and earthenware. May 27.

William Johnson, of Richmond-hill, Surrey, esq., for certain improvements in machinery for boring, cleaving, cutting, and dressing stone and slate, of such kinds as are, or may be used for building, and for ornamental purposes, and for paving of public and private ways. May 28.

John Taylor, of Duke-street, Adelphi, Middlesex, gent., for new mechanical combinations, by means of which economy of power and of fuel are obtained in the use of the steam engine. (Being a communication from abroad.) May 29.

William Walker, junior, of Brown-street, Manchester, hydraulic engineer, for improvements in warming and ventilating apartments and buildings. May 29.

James Fenton, of Manchester, Lancaster, engineer, for an improved combination of alloy of metals, applicable to various purposes, from which brass and copper are usually employed in the construction of machinery. (Being a communication from abroad). May 31.

Joseph Cowen, of Blaydon, Burn, near Newcastle-upon-Tyne, merchant, for certain improvements in making retorts for generating gas for illumination. June 5.

Joshua Proctor Westhead, of Manchester, Lancaster, cotton spinner, for a new and improved fabric, or new and improved fabrics, and also certain modifications of machinery for making the same, which modifications of machinery are applicable to the manufacture of woven fabrics. June 6.

Wilton George Turner, of Gateshead, Durham, doctor in philosophy, for the manufacturing of salts of ammonia, and compounds of cyanogen from a substance never before applied to that purpose. June 10.

Robert Rettie, of Gourock, near Greenock, of Renfrew, Scotland, civil engineer, for improvements in gridirons, frying pans, and other cooking utensils and heating apparatus. June 13.

NOTES AND NOTICES.

A Barometrical Power Engine.—The Albany (U. S.) papers, says Col. Boon, of Hamilton, Madison co. is exhibiting in that city a small machine the motive power of which is independent and the motion it produces is perpetual. The power is obtained by the expansion or contraction of any fluid, mercury, oil, alcohol or water, caused by the ordinary variations in the atmosphere. The model engine, exhibited by Col. B. contains only two quarts of oil in its reservoir, or boiler as it may be called, the expansion and contraction of which moves a weight of twenty-five pounds.

Under Sea and Land in a Storm.—"I was once, however, underground in Wheal Cock during a storm. At the extremity of the *level* seaward, some eighty or one hundred fathoms from the shore, little could be heard of its effects, except at intervals, when the reflux of some unusually large wave projected a pebble outward, bounding and rolling over the rocky bottom. But, when standing beneath the base of the cliff, and in that part of the mine where but nine feet of rock stood between us and the ocean, the heavy roll of the large boulders, the ceaseless grinding of the pebbles, the fierce thundering of the billows, with the crackling and boiling as they rebounded, placed a tempest, in its most appalling form, too vividly before me to be ever forgotten. More than once doubting the protection of our rocky shield, we retreated in affright, and it was only after repeated trials that we had confidence to pursue our investigations. Almost all the mines in the parish of St. Just, near the Land's End, are similarly situated, and the positions of several of the steam-engines are highly picturesque: perched on the verge, and even on the ledge of a tremendous precipice, they seem at the mercy of every storm, and to the beholder from beneath, they almost appear suspended in the air, and tottering to their fall."—*Mr. Henwood.—Trans. Roy. Geo. Soc. of Cornwall.*

American Infringement of an English Patent.—Mr. Henry Stephens (the mechanical drawing ink manufacturer, of Stamford-street,) recently obtained 2000 dollars damages in the United States Circuit Court, against Messrs. D. and W. Felt, stationers, of New York, for their infringement of the plaintiff's patent for making blue writing fluid for ink, and other colouring purposes. It appeared that the defendants did make an article similar to, or in imitation of, that made by the plaintiff, and sold it as the article made by him; but they denied that he was the first inventor of it, or was entitled to any patent for, or monopoly in, the article. Much evidence was adduced for both sides, and the jury found a verdict for the plaintiff for 2000 dollars, liable to be increased in amount by the court.

Literary and Scientific Institutions.—In October last an Act came into operation exempting literary and scientific institutions from parochial rates, on the certificate of the barrister appointed to certify the rules of friendly societies. This week a return has been printed, showing the applications granted and refused under the Act in question. In Ireland six institutions had obtained the certificate, and the barrister had not refused an application. In England and Wales one hundred and eighty-three have obtained certificates, and five have been refused.

The "Great Western" New Boilers.—In the paragraph copied from the *Liverpool Albion*, relative to the *Great Western* steam-ship, which appeared in our last Number, it was omitted to be stated, as ought to have been, that the new boilers were made at the Company's works at Bristol, *under their own direction.* The engines only are by Messrs. Maudslay, Sons, and Field.

☞ INTENDING PATENTEES *may be supplied gratis with Instructions, by application (post-paid) to Messrs. Robertson and Co.*

END OF THE FORTIETH VOLUME.

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